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NOTES AND COMMENTS.

The Case of the Chemical Society.

A CONTESTED election for the presidency of one of the great learned societies of London, is an event too rare to be passed by in silence, even by those who, like ourselves, have no connection with the Society in question, and who do not discuss the subjects of its study. In the present instance, moreover, the contest has formed the subject of lively conversation among all classes of scientific men, and has even been alluded to in the daily press.

Now we are not chemists, and we do not propose to appraise either the scientific or the personal merits of the two eminent candidates for the presidential chair of the Chemical Society. But there are certain features of the contest that call for comment upon grounds common to all scientific societies—indeed, to all societies whatsoever.

The essential facts are these: The Council of the Society, as is the custom, nominated a President and Officers. The Council's nominee for President was objected to by some Fellows of the Society, and they nominated for that post another gentleman, who happened to be one of the Council's own nominees for the office of Vice-President. Further, to give their nomination equal publicity to that by the Council, they sent to each Fellow of the Society a circular letter announcing their action and requesting support for their candidate. In this letter no reasons were given, nor was the slightest attack made on the Council's nominee. As counterblast to this, certain other Fellows issued another circular, not merely defending the nomination by the Council, but objecting quite unwarrantably, as it seems to us, to the action of the Council's opponents and introducing a regrettable personal element. This mode of defence was carried beyond all limits of good taste in a letter that a well-known chemist thought fit to send to the *Chemical News*, a letter for which we hope apologies have since been tendered to the gentlemen named in it. These whips, counterwhips, and

scorpions brought to the poll some 400 Fellows, and resulted in the election of the Council's nominee. The majority, we understand, was not large; but, as so often occurs with the peculiar system of voting enforced by councils, the scrutineers were unable to declare the exact numbers of the votes.

In spite of the bad feeling stirred up, especially by the supporters of the Council, we rejoice that this fight has taken place. If the councils of other societies are disposed to the autocratic attitude of the Council of the Chemical Society, it is, indeed, about time that a little wholesome public opinion were brought to bear on them. This attitude seems to us illogical, peevish, and ridiculous. Theoretically, the council and officers of each society are elected by the fellows of the society; theoretically, each fellow has a vote, which he can cast for any other fellow, or even for himself; theoretically, though it is the duty of the council to submit to the fellows names for election as officers and council, it is in the power of the fellows to propose other names in their stead, and to reject, by their votes, the nominees of the council. We do not find it stated in the Charter or Bye-laws of any society, that its council alone has the power of election. But practically, each council does elect its successors. The election by the fellows is as much a farce as the election of an archbishop. The *modus operandi* is so arranged that opposition is almost inevitably abortive under ordinary circumstances. The method of voting must indeed be cumbrous when the scrutineers cannot count the votes, even in many hours. And when extraordinary circumstances arise, and publicity affords the opposition some chance of success, then, it appears, the proposers of a rival to the council's anointed, are to be gibbetted in the public press as lovers of disorder, ill-wishers to the commonweal, vile traducers of respectable eminence, and, "unkindest cut of all," as young men.

Experience leads us to sympathise with the difficulties of councils, and with the irritation aroused by opposition. None the less, we think it would be to the advantage of every learned society, in many ways, if its council would remember that, theoretically at least, it was elected by the fellows; if it would cease to regard itself as a superior "Treasury Bench," and the rest of the society as "a factious opposition below the gangway." More openness would promote better feeling. More facilities for discussion of the society's affairs would engender more interest on the part of the fellows. A recognised opportunity for fellows to propose their own candidates for the council and officers, and the full publication of the names of all nominees on one ballotting paper, would withdraw the solemn proceedings at Annual Meetings further from the region of burlesque, and might often extract the council itself from a provoking dilemma. Instances of such dilemmas are best left to present themselves to the mind of the intelligent reader. Finally, it would not be amiss if some

members of council, instead of writing abusive letters, devoted their powers of organisation to the invention of a method of voting that should give the nominees of the council and of the fellows an equal chance, and should not result in so many spoiled ballot-papers.

The Army Examinations and Science in Public Schools.

The regulations recently issued by the War Office authorities relating to the examination of candidates for the Army are of such a nature as virtually to render it compulsory that all candidates should offer themselves for examination in some branches of Physical Science. Without expressing unqualified approval of the entire scheme, we welcome this recognition of the educational claims of scientific subjects. It is obvious that not infrequently a knowledge of physics, chemistry, or geology may be of practical value to the Army officer, and thus indirectly to the nation that he serves. The institutions most affected by the new regulations are the Public Schools, for these will be obliged to provide, as indeed some already do, scientific teaching for their army-classes, unless they are prepared to lose all boys who select a military career.

We have lately made inquiries at most of the Public Schools with a view to ascertaining their methods of teaching science, and this leads us to speak not only of their arrangements for army-classes but also of their entire system. At most schools special arrangements are made for army-candidates, and they are accordingly prepared with a view to particular examinations. With regard to the remainder of the boys the provision seems to be utterly inadequate. The Public Schools are dominated to an excessive degree by the classical training; their Head-masters have failed to realise the value of science as an educational instrument, while in many cases the arrangement of the science classes and the number of hours devoted by them to scientific work are such as to render the efforts of the masters nugatory. In short, science is admitted to the Public Schools merely as a sop to satisfy the demands of a public opinion which as yet is too feeble to effect any reforms of value.

We find that at Winchester, Shrewsbury, Charterhouse, Tonbridge, and in part at Eton, Cheltenham and Uppingham, the science classes are arranged according to the aggregate of marks in all subjects, classics, of course, being of greatest weight. Thus, in the worst cases, no matter how incompetent a boy may be in science, if he is a good classic he is hurried up to the senior science division of the school. It is almost inevitable that under such conditions every science class should contain boys of all degrees of ability and its opposite. Thus, the possibility of a rational course of science teaching, beginning with the veriest elements and proceeding to a fairly advanced stage, is absolutely prohibited. The effect produced on any of our classical Head-masters by a term's work with some

half-dozen classes composed of similar classical disparities would form an interesting study, and might perchance convince them of the futility of attempting to teach any subject under such conditions.

The great importance of practical work in the laboratory has not yet been grasped. It is true that at many Public Schools practical work can be done, and is taken advantage of by many training for a scientific career; but the proportion of those who do practical work to those who attend science-lectures shows that the real value of the training has not been appreciated at head-quarters. For instance, at Eton no practical work is done "in school"; at Winchester some 90 boys out of 270 avail themselves of their opportunities; at Rugby about 180 out of 400; at Charterhouse some 30 have the opportunity out of 400 odd; at Uppingham but 14 out of 150; while at Harrow, Shrewsbury, Marlborough, Cheltenham, Malvern, Dulwich, and University College School all who learn science also do practical work.

But to turn from details to general principles of education. The idea is prevalent among too many of those who control the Public Schools that the literary education is the sole method of training a growing mind; accordingly by far the greater part of a boy's time in school is occupied with Greek and Latin. Now a literary taste is possessed by but few, and though we are very far from denying the value of such a training to a boy more disposed to science or the mathematics, yet we deem it monstrous that all boys should, by the average curriculum, be compelled to specialise in the Classics through devoting more than half their time to the subjects included under this term and dividing the remainder among Mathematics, Modern Languages and Science. A classical training is, to the average boy, but a series of appeals to the memory; the faculties of observation, deduction based upon experiment, and natural inquisitiveness are absolutely neglected, and their growth discouraged and stunted. Original thought, independence of action, and self-confidence are in no sense educated by the classics. What is the result? We witness at the present day a perfect mania for athleticism, which, starting in the schools, pervades the great mass of the younger male population. Literature as a recreation is at a severe discount. It is our belief that this athletic craze, so deplorable in its excess, is in no small degree a natural revolt of the mind from the trammels of a one-sided education. In athletics at any rate there is scope for a certain training of hand and eye, it is open to any one by his own efforts and perseverance to attain to the highest things, to act upon his own initiative, to devise some refinement hitherto unthought of, and to gain confidence in self by successful grappling with difficulties.

It is not difficult to pick holes in any system, nor would our present remarks be justifiable were we not prepared with something other than mere destructive criticism. We would suggest to the Public Schools that their education be more general and adapted to

educating not one only, but all the mental faculties. Let the classics hold premier place by all means, but at least give the other subjects a fair representation, and let them be so put before the pupils as to form a true means of education, and not merely as vehicles of gentlemanly information. We consider that every boy should, for his first two years at a public school, be taught science for at least six hours a week, and that fully half of this time should be assigned to practical work. But most important is it that the science classes should be arranged strictly and solely according to merit in science: a rational course of scientific education is almost impossible on any other basis. At the end of two years it is not unreasonable to suppose that a boy will be desirous of devoting his attention more fully to some one subject, but we should like to see all subjects still included in his time-table up to the end of his school career. Just as it is undesirable that a boy should give up all classics for science, so, too, it is most undesirable that the converse should maintain. It is a common complaint among teachers of science that their efforts are hampered by the necessity of confining the work to the syllabus of an examination. This drawback does not exist for the majority of boys at Public Schools, and therefore in these there is an opportunity, such as is denied to many institutions, of teaching science in an educationally scientific manner.

We urgently appeal to the Royal Society to bestir itself in this matter. The governing bodies of most of our great schools contain a member nominated by the Royal Society. Such nominees presumably realise the educational value of the natural sciences, and to their keeping has been committed a national trust of no small value. We look to them for an active interference with the present state of affairs, in fulfilment of their heavy responsibility.

Young Oxford and Science.

The first volume of the Robert Boyle lectures, delivered before the Oxford University Junior Scientific Club, 1892–96, is now issued. It contains the lectures by Sir Henry Acland, Lord Kelvin, Professor A. Macalister, Professor A. Crum Brown, and Professor W. Ramsay, to several of which we have already drawn attention. To it Sir Henry Acland has contributed a preface which concludes with the following interesting remark: "...Natural Science, pursued in the temper of Robert Boyle, has led, does lead, and will lead the young of Oxford to a love of truth for truth's sake, as was foreseen (it may surprise some to learn) fifty years ago by Dr. Pusey, without whose support and that of his friends the final vote would have been lost for founding the Oxford University Museum."

The Robert Boyle lecture this year is to be delivered by Captain W. de W. Abney.

SUPPOSED REMARKABLE SEA-ANEMONES.

EVERY one who is interested in the anatomy of Coelentera must remember the description of figures given by Danielssen of the remarkable actiniarian genera *Fenja* and *Aegir*. It was said that these forms possessed a tubular alimentary canal passing from the mouth to the other end of the body, where it terminated in an anus. This remarkable feature, together with others which it is not necessary to particularise, upset all the current definitions of the Actiniaria and indeed of the Coelentera. It placed an insuperable difficulty in the way of accepting well-known views of the origin of the triploblastic alimentary canal, and in other respects led to modifications in our ideas of invertebrate morphology.

F. E. Schultze and others expressed doubts of the facts described; but the weight of Danielssen's knowledge and experience prevailed, and the genera have found their way into many recently published text-books of zoology.

Dr. A. Appellöf has recently re-examined the original specimens in the Bergen Museum, and the result is that the whole castle of facts and fancies comes crashing to the ground. He proves conclusively that *Fenja* and *Aegir* are but injured, macerated, and introverted specimens of *Halcampoides clavus*, and that the species *H. abyssorum* which came from the same locality is but a synonym of the older species.

Thus ends this ten years' controversy, and a great error is removed from the pages of zoology.

ZOOLOGY AT BERGEN.

DR. APPELLÖF'S paper is published in the Year-book of the Bergen Museum for 1896, which besides the official reports, alluded to elsewhere, contains many interesting communications.

Mr. O. Nordgaard has proved by experiment, that though the eggs of salmon and sea-trout can be fertilised and hatched in water with a salinity of as much as ·9 per cent., they are all killed by a salinity of 2 per cent.

The same worker concludes his systematic list of Norwegian marine Bryozoa: in this part he enumerates the Cyclostomata, of which he includes twenty-four species belonging to nine genera. None of them are new. Mr. Jas. A. Grieg discusses in detail the affinities of *Funiculina* and *Kophobelemnon* two genera of Pennatulids. He also insists on the close relationship of *Funiculina* and *Leptoptilum*, the latter one of the genera founded on material collected by the "Challenger": Grieg does not, however, at present propose to merge *Leptoptilum*. The most interesting general question considered in the paper, is as to the possibility of some of the northern and southern species being identical.

Mr. Grieg also gives a useful list of the Mollusca (194 species)

found in the Sogne Sea, on the West coast of Norway, prefaced by a general survey of the invertebrate and tunicate fauna of the same locality. This is succeeded by a more detailed account of certain nudibranchiate Mollusca, among which a supposed variety of *Tritonia plebeia* receives particular attention. The author nowhere considers the possibility that his "colossal variety" is simply a young specimen of *Tritonia hombergii*, a view which is nevertheless rendered extremely probable by his figures and description.

Professor R. Collett gives a detailed description of the interesting deep-bodied Scomberoid fish *Pterycombus brama*, with beautiful figures both of the external aspect and the skeleton.

In a systematic note on the holothurians of Norway, Mr. Hj. Östergren confirms the view already expressed by Théel, that the supposed spicule-less form named *Holothuria ecalcarea* by Sars has lost all its calcareous structures through the action of acids. It appears to be a *Stichopus* closely allied to, if not identical with, *S. tremulus*. It follows from Östergren's researches that our common British cotton-spinner is the only true *Holothuria* found beyond the two 50th parallels of latitude.

There are also in the *Aarbog* a systematic review of the Collembola of Norway by O. J. Lie-Pettersen, faunistic researches in Osterfjorden by A. Appellöf, and a study of the eyes in *Pecten* and *Lima* by K. E. Schreiner.

The Eyes in *Pecten* and *Lima*.

In *Pecten*, and indeed in many other animals whose eyes are even better known, the relation of the nerves to the retinal cells is still in dispute. According to Patten, a nerve-fibril runs axially through the rod-cells and rod, emerging at the tip of the latter in order to bend back over its outer surface, which is thereby covered with a complicated network of fine nerve-endings. Mr. Schreiner denies the existence of any such axial nerve or canal, but maintains that the appearance is produced merely by the shrinking of the cells so as to form longitudinal ridges, while the axial thread that is to be seen in the rod itself is, according to him, merely the continuation of the protoplasm of the rod-cell. Patten's statement that the outer ends of the rods project slightly through a definite, perforated membrane, which he calls the "vitreous network," though rejected by Rawitz, is confirmed by Mr. Schreiner, who further supports Patten in his view that the rods are not, as maintained by Carrière, embedded in a fatty substance, for such an appearance is easily produced by reagents. External to the rod-cells are the 'ganglion cells,' which, over the central region of the retina, are in three or four layers, but at the periphery form only a single layer. The optic nerve, as is well known, branches, one branch going to the proximal base of the eye, the other running laterally past the retina in order to bend round on to its distal surface. Here the retina, says our author, is covered by a

septum, "through which the greater number of the nerve-fibrils pass near the centre"; the fibrils are continuous with the filamentous ends of the rod and ganglion cells.

Mr. Schreiner doubts whether the glittering 'argentea' or 'tapetum,' against which the tips of the rods rest, is, when the adult stage is reached, in any way a cellular structure. The same difficulty arises as to the pigment. Among those who have studied it—Bütschli, Carrière, Hensen, Hickson, Patten, and Rawitz being the foremost—Hickson stands alone in maintaining the pigment-mass to be non-cellular. This is, in fact, the case, according to Schreiner, in *Pecten maximus*, which Hickson examined, and also in *P. islandicus*. In these forms the pigment is a brown-red fluid; but in other cases investigated the pigment-layer is distinctly cellular.

With regard to the interesting problem presented by what is called the inversion of the eye, *i.e.*, the turning of the retinal cells away from the light, the author looks only to the study of its development for a solution.

Mr. Schreiner concludes that the eyes of *Pecten* are true eyes. He will have nothing to say to their being 'heliophags' or energy-absorbers, as suggested by Patten. He rejects, moreover, the interpretation of Rawitz, who has supposed that the numerous eyes all act together like the ocelli of a compound eye.

On the edge of the mantle in *Lima excavata* are some very simple eyes. They are nothing more than open pits, irregularly filled by masses of slime, and are thus of no small importance in the comparative study of visual organs.

Archæology at Bergen.

Papers no. vii., ix., and xv. of the same Year-book refer to recent acquisitions by the Bergen Museum. The first, by G. Gustafson, deals with the pre-Reformation relics acquired in 1895, including several grave-finds of early and late Iron Age, important additions to the already fine series of grave-finds in the museum. The second, by B. E. Benedixen, describes some interesting additions to the Mediæval collection: a painted panel of 14th century date, from the church at Lyster, and a second panel from the church at Eid in the Romsdal, probably of early 14th century date, and differing in style from the other. A fine piece of gold and red textile work is described, with a coloured plate, its *provenance* being Röldal Church in the Hardanger district, also a handsome bronze candelabrum surmounted by a figure of the Virgin (Mutter-gottesleuchter) from Kinservik, probably of German make, c. 1500. The third memoir, also by Mr. Gustafson, treats of an important find of silver coins and ornaments, including over 400 coins of Æthelræd, Knut, Sigtryg and others.

For the sake of completeness we may mention here an elaborate

account, by C. F. Kolderup, of the labradorite rocks near Ekersund and Soggendal, the first of a series on these rocks in western Norway.

All the memoirs mentioned in this note are well illustrated by plates and text-figures, and they, like the zoological articles, reflect the greatest credit on the staff of this museum.

Formol for Zoological Specimens.

The following valuable remarks occur in the Report of the Director of the Colombo Museum, Dr. Amyrald Haly, for 1896. They are so likely to escape observation there, that we venture to reprint them *in extenso*.

"I reported last year that the use of formol amounted to a revolution in Museum work; twelve months' further experience has given me no cause to change my opinion. I find one and a half to two per cent. solution quite sufficient for invertebrates in general, and three to three and a half per cent. for vertebrates. It is not, however, its marvellous preservative power that is so striking, as the possibility of keeping objects in it which can be kept in no other way, or only with great difficulty. A striking instance of this is seen in jelly fish, which can be at once placed in a one and a half solution of formol and salt water, and retain all their transparency unimpaired. Earthworms are also perfectly preserved in this medium."

"Formol is an admirable preservative for spiders, and does not seem to injure their colour to any great extent. If sheets of cork painted white are inserted in flat-sided bottles, spiders can be pinned and set in the same way as insects in insect boxes, and as the collection increases they can be classified and arranged in their family and genera with perfect ease, and when space is provided will form a very beautiful exhibit."

"Our frog collection has been deteriorating greatly of late years. The fact is these animals will not keep in spirit in this climate. If the spirit is strong they wither up beyond identification, if weak they get covered with a deep red fungus. I went through the collection carefully, re-identified and re-numbered the specimens, and transferred the whole to three per cent. formol."

For a general account of formol, readers, who have not yet utilised its wonderful properties, may be referred to Mr. James Hornell's article "The Use of Formalin as a Preservative Medium for Marine Animals," Natural Science, vol. vii., pp. 416–420, December, 1895.

The Preservation of Fish and Reptiles.

In the Report of the South African Museum under the head "Fishes" it is stated: "Special attention has not been paid hitherto to increasing the number of specimens for exhibition in this class,

owing, not only to the expense of preserving the specimens in spirit, but also to the impossibility of presenting them to the public in anything like their natural condition. Mounting or stuffing fishes is the art in which taxidermy has achieved least, and it is imperative that our South African fishes for exhibition should be modelled and coloured from nature by a skilful artist."

Mr. Haly, however, seems to have solved the problem of preservation for exhibition purposes: he writes thus:—"A specimen of a wrasse prepared by the gum and glycerine process in November, 1884, is now in my office, having been exposed to the light for the last thirteen years, and not a single tint has faded." Dr. Haly's original paper on this method and its alternative of "carbolicised" oil was published in the *Journal* of the Ceylon Branch of the Royal Asiatic Society, vol. xii., pp. 65–73 (1892). The paper concludes with the following recipe, which we quote for the special benefit of our many readers in tropical countries: "Add carbolic acid to cocoanut oil till the oil marks 10 to 20 degrees below proof on an hydrometer. The more powerful the acid, the more powerful the dehydrating effect, and judgment must be used. In this climate it is best, although not absolutely necessary, to remove the entrails. Place the specimen, carefully wrapped in rag, in plenty of this preparation. If wanted to mount for show, drain off the superfluous oil and mount in glycerine."

"Many of our exhibited specimens," continues Dr. Haly in his Report of 1896, "prepared by these methods date from 1885, and none are less than four years old. Casts, however carefully painted, can never give the same effect as the natural tints seen through a highly refractive medium. If, however, the gum and glycerine process is objected to on the score of its expense, or the carbolicised oil process on account of the difficulty of eliminating the oil from the specimen, which is however merely a question of time, mixtures of chloride of zinc in spirit or of formol and carbolic acid are both free from the above objections. I cannot give the exact proportions of the chloride of zinc and spirit, which probably ought to vary with the character of the fish to be preserved, but a three per cent. solution of half carbolic acid and half formol seems to be perfectly satisfactory. I have lately preserved a wrasse, *Julis lunaris* (Linn.), by this means, the colour of which is the most difficult to keep in the whole animal kingdom. The specimens should of course be transferred to glycerine as soon as possible."

"With regard to reptiles, I find the chloride of zinc and spirit mixture one of the best mediums for resisting the desiccating action of glycerine. I employ proof spirit raised to the specific gravity of sea water by the addition of Burnet's solution. A specimen of *Lyriocephalus scutatus* preserved in this way three years ago still retains all the softness of its brown and yellow tints, and the delicate opalescence on the shoulder."

How are Crustacea to be Preserved?

These animals are still a difficulty. Dr. Haly "can find nothing to supplant gum and glycerine for the preservation of their colours; they must not be placed in spirit before being placed in the solution, nor must the solution be reduced by spirit. If they are touched by spirit in any way the glycerine produces in a few hours great white blotches on the carapace, causing a horribly leprous aspect. This necessitates for large specimens the use of a large quantity of the gum and glycerine solution, which has then to be thrown away instead of being used several times as is the case with fish; the expense, therefore, becomes almost prohibitive. The effect of formol and carbolic acid is the same as boiling water, and the chloride of zinc solutions are most destructive. I am in hopes that solutions of gum in formol may solve the question."

We should be glad to receive communications on the above subjects. No doubt the curators of some of our great museums, especially the energetic Assistants in the Zoological Department of the British Museum, have been experimenting on these lines. It would be of interest and value if they would detail the results of their investigations.

The Fixation of Soft-bodied Marine Invertebrates.

On this subject we have already published various notes, and the present observations by Dr. Haly form a welcome addition. "Of late years," he writes, "I have received recipes for the display of marine animals by the Neapolitan methods, but I must confess that I have never seen any sign of success with any of them. I imagine that some practical training by a master of the art is necessary."

"On the contrary, Thulberg's 'Solution of Chloride of Magnesium' promised well from the first, and I have been equally successful with Epsom salts, which was suggested by some English naturalist for sea anemones. No class of sea animals can resist the action of these salts. The secret of their use is very simple: the salt must be dissolved in fresh water until the solution attains the specific gravity of sea water; this solution must then be mixed with from four to six parts of sea water. All forms of marine life display themselves in these mixtures to the utmost perfection. The difficulty is to transfer them to the formol: some require no fixing, and, curious to say, amongst them such delicate and excessively contractile forms as the Tubicolar Annelids and the Gephyræans. On the contrary, the Holothurians and the Nudibranchiates are extremely difficult to preserve in an extended state. Of the ordinary fixing agents, bi-chromate of potash seems to answer better than any. I have also been successful with excessively weak solutions of alcohol and by allowing alcohol to float on the top of the water, and thus mixing with extreme slowness. But I can give no recipe which works with certainty."

"The difficulties of these investigations on the coast of Ceylon are very great. We have no tide, and specimens are only to be found on isolated reefs of limited area, situated at great distances apart; these are only accessible for three or four months out of the year, and at the best of times they afford but little variety. I trust that other naturalists will take this subject up. The method is extremely cheap, simple and effective, and I am sure that with those opportunities which are denied to me a certain and simple process of fixing the more difficult will be easily found."

We echo this wish. And we cannot conclude without congratulating the Colombo Museum on having a Director who not only does such excellent curatorial work, but whose zoological studies on the fauna of Ceylon, numerous evidences of which appear in the Report from which we have quoted, are so varied and so valuable.

PRESERVATION OF VERTEBRATE TISSUES.

IN connection with Dr. Haly's experiments, we may allude to a method of preserving the tissues of Vertebrata, described not long ago by Dr. Kaiserling in the *Klinische Wochenschrift* (Berlin). The method has, it is stated, been tried with satisfactory results, the natural colour of the blood and the transparency of most of the organs having, so far, been maintained. The organ is first placed in a solution of 750 c. cm. of formalin, 1,000 c. cm. of distilled water, 10 gr. nitrate of potash, 30 gr. acetate of potash, and allowed to remain for some twenty-four hours; it is then immersed for two hours in 80 per cent. alcohol, for two hours in 95 per cent., and is subsequently preserved in equal parts of water and glycerine, with the addition of 30 parts of acetate of potash. Very delicate tissues are best kept in equal quantities of glycerine and water, after the addition of absolute alcohol in the proportion of one part of alcohol to ten of the mixture.

FEVER IN PLANTS.

MR. H. M. RICHARDS, who has previously studied the effect of wounds on plant-respiration, now describes (*Annals of Botany*, xi., 29) a course of experiments on the evolution of heat by wounded plants. He finds that accompanying the increased rate of respiration is an increase in the temperature of the parts affected. A kind of fever supervenes, and as in the case of respiration, the disturbance runs a definite course, and attains its maximum some twenty-four hours after injury. It is interesting to note that the attempt to rally from an injury is accompanied by somewhat the same symptoms, increased rate of respiration and evolution of heat, in plants as in animals. Owing to the nature of the case the reaction is less obvious in the former than in the latter, and a delicate thermo-electric element was required to appreciate the rise in temperature; but compared with the ordinary temperature of plants in relation to the surrounding

medium, the rise after injury is "as great, if not greater than in animals." The maximum in all the plants investigated was between two and three times the ordinary excess above the surrounding air. Potatoes proved the most satisfactory objects for experiment, and it was found that in massive tissues (such as potatoes or radishes afford) the effect of injury was local, whereas in the case of leaves (*e.g.*, onion-bulbs) a much greater extent of tissue was sympathetically affected.

Bulb-Growing.

Daffodils and other species of *Narcissus*, hyacinths, tulips, and other bulbous plants are so common and so cheap in the early spring markets that we are prone to wonder where and how they are grown. We remember noticing a statement some years ago that early potato cultivation had been given up in parts of the Scilly Islands in favour of the daffodil. At present, however, we are interested in a suggestion by Mr. F. W. Burbidge, in a lecture to the Birmingham Gardeners' Mutual Improvement Association, reported in the *Gardeners' Chronicle* (March 27). "We are told" he says "by politicians nowadays that thrift and home industries are essential, and while some advocate milk or meat, or poultry and eggs, or jam-making, or the 'Busy Bee' industry, I will advocate bulb-culture." In Holland and elsewhere it is the small growers who supply the wholesale growers and the merchants, and Mr. Burbidge thinks that what can be done in Holland could be done by the small farmer, the cottager, the allotment-holder, and even the railway porter, in our own country. Bulb-culture, he tells us, on suitable sites and soils has proved to be the most profitable of all cultures in neighbouring countries, as well as in Cornwall and the Scilly Islands, and if the English gardener will only have more faith in himself, and in the soil and climate of his native land, the day may come when our great bulb-merchants will not be obliged to go abroad with their big cheque-books once or twice a year. We are glad to note this suggestion in applied botany, and are seriously thinking of trying to work out the hints on cultivation, &c., which Mr. Burbidge supplies, and grow a few bulbs on our own account. At any rate it is a point for the depressed agriculturist to note. Fruit-growing for jam-making depends largely for success on the cheap sugar which we buy from the Continent to the ruin of our West Indian Islands. The present Sugar Commission may perhaps alter this. In such a case it is reassuring to think that we can then fall back on bulbs, if only they can be got cheaply enough to market. Apropos of this last remark we notice in the same number of the *Gardeners' Chronicle* (p. 206) a paragraph entitled "Pleasant for the British Farmer." One steamboat, to be soon followed by two others, has lately been put on the service between Antwerp and London with the result that "any package of poultry, fruit, eggs,

vegetables, &c., consigned to a Belgian station before 8 a.m. is delivered the next morning in the London markets at 5 a.m." The carriage rates are not given, but their advertisement would probably not add to the farmers' joy.

THE ANTIQUITY OF MAN IN THE EASTERN UNITED STATES.

THE Delaware caves and the Glacial Gravels of Trenton, New Jersey, have long been regarded by some writers as affording evidence of Glacial Man, although others have not accepted this conclusion. The question has been thoroughly investigated by Mr. Henry C. Mercer, curator of the Museum of American and Pre-historic Archæology of Pennsylvania University. Mr. Mercer had previously sought for the remains of pre-historic man in the hill-caves of Yucatan, Central America (*see* NATURAL SCIENCE, vol. viii., p. 159, 1896), and had further qualified himself for the present researches by study of drift implements in the museums and private collections of Europe, and of the localities at which they have been found in England, Belgium, France, and Spain. The result of his investigations, which may therefore be accepted with considerable confidence, appears, with with one or two other essays, in a well illustrated volume of 178 pages, entitled "The Antiquity of Man in the Delaware Valley and the Eastern United States" (Ginn & Co., Boston, U.S., 1897).

Mr. Mercer failed to find a single specimen in place at Trenton, and became convinced that the argillite "turtlebacks" on which so much stress has been laid, were "rejects" or wasters "the work of modern Indians and intruded" into the glacial gravels. He shows that whole quarries of argillite were worked by Indians, whose village-sites are in the vicinity. The fact that after most careful and prolonged search nothing was discoverable anywhere else in the Delaware Valley to corroborate the alleged antiquity of the chipped blades from Trenton has led him to the conclusion "that the question of glacial man has been narrowed down to evidence produced at one site, and to a question of the correctness of observations of individuals."

The same volume records the story of the exploration of an Indian ossuary on the Choptauk River, Maryland. Professor E. D. Cope describes the physical characters of the bones found there, and Dr. R. H. Harte discusses their diseased conditions. Mr. Mercer's investigations of an aboriginal shell-heap on York River, Maine, yielded evidences of cannibalistic practices. He also describes an interesting rock shelter in Triassic shale, known as the "Indian House," in the Delaware Valley, and recounts his exploration in 1893 of the famous Durham cave, which made known the fact, interesting to palæontologists, that a species of an extinct genus of the peccaries (*Mylohyus pennsylvanicus*, Cope) had far out-lived the epoch usually attributed to the animal in North America. Its remains were undoubtedly "mingled with those of still existing animals, if not with

the contemporary refuse of Indian cookery of post-glacial times." They recur elsewhere associated with those of the tapir, mastodon, and fossil sloth, which thus within "a comparatively few centuries" all roamed the forests of the Eastern United States.

The Extinction of British Butterflies.

In a recent short article in the *Entomologist*, Mr. W. Harcourt-Bath discusses the causes which have led to the dying-out of several of our native butterflies. He does not believe that climate has much to do with the extermination of these species, and he considers that even the rapacity of collectors has been less destructive than two other factors: the abnormal number of insectivorous birds owing to their protection and the persecution of their enemies, the hawks and owls, and the wearing-out of the butterflies by insular isolation and consequent in-and-in breeding.

That the senseless destruction of birds of prey by game-preservers may have such an effect on insect-life as Mr. Harcourt-Bath supposes is likely enough, but we fear the consideration will not have any effect on the slaughterers of so-called "vermin." The isolation factor is much more doubtful. Mr. Harcourt-Bath supports it by stating that the extinct or dying species have weak powers of flight, while our dominant butterflies are constantly recruited by immigrants from the Continent. On the other hand it may be urged that many species of Lepidoptera, with an excessively limited range—confined to a few discontinuous strips of our western coasts and presumably among the oldest inhabitants of our islands—show no signs of dying out except by the greed of the insect-hunter or the money-hunter; for unfortunately British Lepidoptera have a most sad pre-eminence among natural objects in their high market value. Their extinction will only be checked by the extinction of the "mere collector" and the dealer who supplies him.

We have said that Mr. Harcourt-Bath's article appeared in a recent number of the *Entomologist*. From the reprint supplied we can derive further information only with difficulty. The covers tell us the names of the editors and publishers, the price and terms of subscription of the magazine, but we look in vain for the date or number of the volume. However, at the bottom of the article, we find that it was written in November, 1896, and we therefore venture to give the reference as *Entomologist*, 1897, pp. 55–8.

The Extermination of the Golden Eagle.

Mr. Joseph Collinson sends to us from the Humanitarian League the following protest:

"The bird butchers are at it again. In the *North Eastern Daily Gazette* of February 17th, it is recorded that a golden eagle has just been shot in East Yorkshire. This is the second killed within three

months near the coast, and I have authentic records of two more instances which occurred in Scotland during 1896.

"Seebohm, one of our most able and reliable naturalists, says:—'Before it is too late, Scotchmen, protect your national bird, the eagle of your ancestors, and stay the cruel war waged by grouse-shooter, deer-stalker, sheep-farmer, and skin-collector—war which will, ere long, play its part but too surely and take the eagle from your mountains for ever.'

"What are our County Councils about? The powers given them by the Wild Birds Protection Acts of 1880 and 1896 ought to be enforced more vigorously and universally than they are. A period of protection for the golden eagle is eminently desirable, and it is to be hoped that the councils representing the counties in which the golden eagles have recently been destroyed will make application to the Home Secretary to deal with the matter in a way which will in effect secure protection for the bird all the year round."

The sentiments are admirable; but we are somewhat perplexed to find so competent an ornithologist as Mr. G. W. Murdoch of the *Yorkshire Weekly Post* casting doubt on Mr. Collinson's statements: "I do not believe," says he, "a golden eagle has been killed in Yorkshire for nearly half a century."

BUFFALOES.

THE *Scientific American* for February 20 contains an interesting account by G. E. Walch of the destruction of the buffalo in North America, and of the attempts that are being made to domesticate and preserve the few individuals that are left. There is a small herd in the Texas Pan Handle, numbering less than 75, a larger one at Ravalli, Montana, numbering nearly 200. The latter belongs to Mr. C. Allard, who has crossed the wild animals with the polled Angus stock, thus producing a breed more fitted to withstand blizzards than are ordinary cattle. There is a small herd of buffalo, numbering 20, on Antelope Island in the midst of the Great Salt Lake, where during 1896 four calves were born.

FURTHER evidence of the age of the plant-bearing beds of South Africa has just been brought before the Geological Society of London by Mr. A. C. Seward, from material sent to him by Mr. David Draper, of Johannesburg. Mr. Seward is led to the conclusion that these beds are of Permo-Carboniferous age. We are inclined to believe, however, that the evidence of the fishes and of the reptiles (as pointed out by Professor Seeley) is more in accordance with a Permian or even Triassic age than with a Carboniferous one. The "Lepidodendroid" plants, stated by Professor Seeley to occur in association with *Glossopteris*, at Aliwal North, have, however, not yet been seen or examined by any botanical expert in this country.

I.

Human Evolution.

IV.—Mr. Archdall Reid States His Position.

AT the outset I desire to thank Mr. Buckman for the obviously friendly tone of his article in your March number. As to the first part of his indictment I must plead guilty: the title of my book does not cover its whole contents. But the first part which deals with "Organic Evolution" was originally intended to be merely preliminary to the second part, which deals especially with man's present evolution. Without it the book would have been unintelligible to the general reader, and full of mere dogma to the biologist. For example, the theories of Retrogression and Variability, which were essential to my argument, and which appear to have met very general acceptance, have not to my knowledge been propounded elsewhere.

But as to the second count of Mr. Buckman's indictment I must demur. I think I may fairly claim that my book does indicate in all essentials the whole of man's present evolution. Mr. Buckman is, however, in excellent company. For example, Mr. Alfred R. Wallace wrote in *Nature* (April 16th, 1896), "The latter portion of the book, which gives the title to the work, though original, is somewhat disappointing, as it is entirely limited to evolution against disease." Professor Ray Lankester wrote in the *Fortnightly Review* (September, 1896), "I am by no means satisfied that the present and future evolution of man is being determined exclusively or even mainly in the simple way, and by the obvious factors which he has placed before us." Other critics have expressed themselves in similar terms, the implication always being that man's present evolution is exceedingly complex, and that the evolution against disease and narcotics forms but a small part of it. I think however that the contrary can be proved.

The whole matter, in my opinion, turns on the question so long and so hotly debated, as to whether acquired traits are, or are not, transmissible. If they are not transmissible, and evolution, therefore, results solely from the selection of favourable congenital variations, then the problem is simple, for, by taking note of the main lines of elimination, we can easily ascertain all the directions of evolution. Now men, at any rate civilised men, perish almost solely of disease or of the effects of various narcotics such as alcohol and opium. Man's present evolution is therefore almost solely against disease and

narcotics. Practically speaking, all other causes of elimination too slightly effect the survival rate to be causes of evolution: and moreover, these other causes do not, under modern conditions, generally eliminate particular types of individuals; for example, individuals who perish of starvation, are not necessarily those who are least able to endure prolonged abstinence from food, but generally those who, owing to other causes (*e.g.* the effects of disease), are unable to procure food; again, those who perish of drowning are not in particular those who are least fitted to acquire the art of swimming, but quite chance individuals. Little or no evolution, therefore, can result from these minor causes of elimination, and therefore the present evolution of man is in a direction altogether different from his past evolution during which were evolved his physical and mental parts.

It is possible that had these considerations been present to the minds of my critics, some of their strictures would not have been written. For example, Mr. Buckman says: "It is strange that a work entitled 'The Present Evolution of Man' should take no account of the reproduction question. For instance, there is at the present day a sudden decrease in the birth-rate. It undoubtedly corresponds with the rapidly-spreading knowledge of chemical means for checking fecundation. The less fertile race will inevitably succumb to the more fertile, and this decrease of the birth-rate heralds its disappearance. It is remarkable that a book dealing with the evolution of man says nothing of a factor more important than any it treats."

But supposing the English, for example, used artificial checks to fecundation and the Irish did not, what, let me ask Mr. Buckman, does he conceive would be the direction of the resulting evolution? What would be the physical or mental change? Surely it is clear that, since no particular type of individual would be selected, no evolution could result. Even if the English became altogether extinct from this cause and were replaced by the Irish, it is clear that the surviving race would not undergo evolution, since among them there would have been no elimination. In fact, if we premise that congenital or inborn variations are alone transmissible, we must conclude that the evolution of even a very highly complex animal such as man can seldom at any one time have proceeded on very complex lines. His different structures must have been evolved, under the changing stress of Natural Selection, during different but overlapping epochs of a long-extending past. What perceptible evolution, for instance, have such highly important organs as his hands and feet, his eyes and ears, his heart and lungs, etc., undergone for thousands of years? When any of these attained such perfection as to place man in harmony with that portion of his environment with which it was concerned, its evolution ceased, and the direction of man's evolution changed.

If, however, we premise that acquired modifications are trans-

missible, then, it must be admitted, that the evolution of man and every other complex animal is proceeding on enormously complex lines—on lines so complex that it would be hopeless for any man to attempt to delineate them in their entirety. But are they transmissible? Mr. Buckman thinks they are. He writes: "The germ is a unicellular organism, and therefore it should be modifiable in accordance with its environment. Such environment would be different in the body of a sedentary clerk, and of a hard-working agricultural labourer; and on this hypothesis the offspring in these cases would be different."

He misses the point at issue. It is not denied that changes in the germ's environment (*i.e.*, in the body of the parent) may result in modifications in the organism into which the germ subsequently proliferates; but it is strenuously denied that acquired modifications in the parent tend specially so to modify the germ as to cause the organism into which it subsequently proliferates to reproduce congenitally the modifications which the parent acquired. To take a case mentioned by Mr. Buckman: "Visits to the Inventions Exhibition by the mother during the period of gestation resulted in a child which, unlike the others, has shown, since infancy, a remarkable mechanical proclivity." So that Mr. Buckman contends that the slight cerebral change in the mother so affected the child, situated on the other side of the placenta and at the end of the long umbilical cord, that a much greater cerebral change resulted in it. The seeing of inventions by the mother rendered the child inventive. Surely this hypothesis, savouring as it does of the miraculous, is unnecessary when we remember how greatly twins or the individual members of a litter of puppies (which cannot inherit different acquired traits from their parents since the circumstances attending their genesis are precisely alike) may differ mentally and physically.

Several of my critics have declared that they are weary of the endless controversy as to the transmissibility or non-transmissibility of acquired traits. Not words but deeds are required, say they. Not arguments, but careful physiological experiments. They are difficult to please. It is impossible to imagine how physiological experiments can be devised more profound and convincing than that enormous series, conducted by the micro-organisms of disease, to which I have called their attention. Thus, for example, for uncounted generations, almost every individual in Europe, who has reached an age to propagate his species, has acquired, through illness and recovery, immunity to measles. Yet this acquired immunity, this profound constitutional change, that not merely affects this or that organ, but the whole body, has not in the slightest degree been transmitted. The European child is as liable to infection as were the children of his remote ancestors, or as are the children of Polynesians, who have only lately been afflicted with the disease. He differs, however, from the Polynesians, and presumably also from his remote ancestors, in that after

infection he is more resistant to the disease, *i.e.*, in that he more easily attains immunity, and does not so readily perish. Mr. Buckman thinks that this evolution of resisting power "looks remarkably like inheritance of acquired characters." But, if acquired powers of resisting are transmissible, acquired weaknesses should also be transmissible. And, therefore, in the case of such diseases as tuberculosis and malaria (against which immunity cannot be acquired, and of which one attack predisposes to subsequent attacks), races, long afflicted by them, should be much less resistant than races that have had little or no experience of them. The contrary however is true, for the negro is more resistant to malaria, and much less resistant to tuberculosis than the Englishman. In this case, therefore, acquired immunity can have played no part.

Again, indulgence in certain narcotics increases the craving for them; and some of these narcotics (*e.g.*, alcohol and opium) are the cause of a vast number of deaths. If, then, acquired traits are transmissible, a race that has long used a powerful narcotic should crave more for excessive indulgence in it than a race that has had but a short acquaintance with it; on the other hand if acquired traits are not transmissible, then the elimination of individuals with a great craving would render the former race less liable to excessive indulgence than the latter. Now the evidence is overwhelming that races that have longest used a powerful narcotic are invariably those that are least inclined to excessive indulgence in it. Here then is another great series of physiological experiments proving, just as disease proves with regard to acquired physical traits, that acquired mental traits are not transmissible.

We must conclude, therefore, that since the great causes of elimination are not very numerous, man's present evolution cannot be very complex; and, therefore, since I have dealt with all the great causes of elimination, that I am justified in my claim that my work really does cover the whole ground.

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II.

The Lemurs as Ancestors of the Apes.

THE question whether the lemurs are the ancestors of the apes needs to be discussed again, as the result of the recent investigations of Hubrecht (1) and Leche (2) on the Tarsier (*Tarsius*) of the Indo-Malayan Archipelago. This little squirrel-like animal, as is well-known, has long been placed in zoological works in a rather isolated position among the lemurs, on account of its anomalous characters. Hubrecht now finds, from the study of the placental connection between the embryo and the parent, that this strange genus can no longer be regarded as a lemur, but must be placed among the apes in the higher division of the Primates. Leche, on the other hand, from a study of its teeth, considers that it is a lemur beyond all doubt.

I propose, therefore, as briefly as possible, to discuss the characters of the skeleton of *Tarsius*, to determine whether or not this existing genus can be considered as a synthetic type connecting the lemurs with the apes, and whether it truly shows that the two suborders of the Primates, as commonly understood, are derived from one and the same ancestral stock. The animal is, indeed, one of those generalised forms, preserving in its skeleton many characters found in its primitive ancestors of the Eocene period, as shown by an examination of the skull and teeth.

The skull of *Tarsius* very closely resembles that of *Anaptomorphus* from the North American Eocene, and of *Microchoerus* from the French Lower Tertiary Phosphorites. All these animals have a rather short and broad head, with much enlarged orbits, and huge auditory bullæ. In the skull of the two extinct genera, however, the rim of the orbit is incomplete below, while in *Tarsius* it is nearly closed here by a well-marked lamina of bone extending from the alisphenoid to the malar. The latter feature has not been observed in any other lemuroid, and more closely associates *Tarsius* with the apes.

The teeth of this animal are of a very primitive type, which is common in the lowermost Eocene strata. Like nearly all the Mammalia of the North American Puerco Formation (lowermost Eocene), it exhibits only three tubercles on the crown of its back teeth in the

upper jaw, while its lower molars bear a raised triangle of three cusps in front with a low heel behind ("tuberculo-sectorial" type of Cope). The front teeth are peculiarly modified, and in respect to these *Tarsius* resembles the Insectivora much more than any existing lemur. Whereas the upper canines of the true lemurs are large, those of *Tarsius* are comparatively small, while its upper median incisors are much enlarged and upright in position. Leche considers that this arrangement is primitive, since he finds that in the milk-dentition of the Eocene lemuroid *Adapis* the canines are much smaller than their permanent successors and more closely resemble the anterior premolars.

The latter conclusion, however, is not supported by the palæontological evidence when we examine it closely. According to our present knowledge of the fossil Primates, two well-marked series of supposed lemuroids were already differentiated as early as the beginning of the Eocene period (Puerco stage). In one series, that of the Mixodectidæ, the lower median incisors were larger than the adjoining teeth, and there were only three premolars. In the second series, that of the Chriacidæ, the canines were larger than the incisors and normal in form, while there were four premolars.

Now, *Tarsius* is similar to the Eocene Mixodectidæ in exhibiting one pair of anterior lower teeth enlarged, though in this case it happens to be the second pair instead of the first. One of the essential characters of the animal may thus be traced back to its ancestors at the beginning of the Tertiary period. But notwithstanding the specialisation of the front teeth in *Tarsius*, the molars are of a generalised type from which those both of the lemurs and the apes might have been derived; and it is interesting to add that the teeth of the American Eocene *Anaptomorphus*, so far as known, are very much of the same character. It must be remembered, however, that the number of premolars in *Anaptomorphus* is not yet satisfactorily known, and this is an important point still to be settled; though it seems probable there were three of these teeth as in *Tarsius*.

The best known of the extinct lemurs are the genera *Adapis* and *Microchoerus* from the upper Eocene of Europe; and here we meet with two widely differentiated types, the second closely related to the American Mixodectidæ. *Adapis* is evidently very similar to the modern lemurs, only differing from them in the normal form of its canines and incisors. The actual pattern of its molar teeth differs much less from that of the recent lemurs, for example, than does that of *Mycetes* from the American monkeys generally. The peculiar proclivous position of the incisors and canines of modern lemurs is a character probably of late acquisition, as it appears probable that *Megaladapis* of the late Tertiary of Madagascar had the canines and incisors of a normal form. The shape of the jaw symphysis in *Megaladapis* leads me to this conclusion. The ancestral form, then, of all the lemurs was probably provided with large upright canines and normal

incisors. In some of its cranial characters, *Adapis* more closely resembles the apes than the lemurs. I refer to the nearer approach of the lachrymal foramen to the orbit than in the typical lemurs; and then again the jaw symphysis is strongly anchylosed and the angle rounded as in the apes. These characters, with the large canines of *Adapis magnus*, give the skull of this species quite an ape-like appearance. In general, the genus *Adapis* might be considered as ancestral to some of the recent lemurs, as the complex character of the last premolar of *Adapis* is found in the recent genera, *Hapalemur* and *Galago*.

Turning to the characters of the skeleton of *Tarsius*, we find them nearly all essentially those of the lemurs. As in the latter, the fourth digit of the pes is longer than the others, and the index and middle digits of the hind feet are furnished with claws. Again, the calcaneal and navicular bones of the tarsus are elongated as in *Galago* and *Cheirogaleus*. It is interesting to note, and this goes hand in hand with the other primitive characters of *Tarsius*, that there is one more claw on the hind foot of *Tarsius* than in other lemurs; and I believe that this point is an important one in its bearing on the phylogeny of the Lemuroidea.

The view has been advanced that the lemurs were descended from condylarthrous ancestors. Now, by Professor Cope's latest definition (3) of the Condylarthra, they were all hoofed quadrupeds, and to my mind it would be impossible to derive the claws and nails of the lemurs from any hoof-like type. I am convinced from a study of the terminal phalanges of the lemurs, that these have been developed from claws and not hoofs. Nails arise by the distal expansion of claws, and this is proven in the case of the lemurs by tracing this development in the individual digits of living lemurs.

There are a number of forms included in the Condylarthra, such as *Periptychus*, which are very doubtful, and excluding these uncertain condylarths, we are confined for our comparison to the type genus *Phenacodus*. If we compare the structure of *Phenacodus* with that of *Adapis*, the best known of the fossil lemurs, we find little in common between them. *Phenacodus* is a typical ungulate closely related to the perissodactyle division of that order. On the other hand *Adapis* in its skeletal structure is in general different from *Phenacodus*, and this applies as well to the details of its cranial anatomy as to the structure of the limbs. If we take into consideration the difference in structure between the lemurs and condylarths, I am sure that the idea of deriving the former from the latter is untenable. The serial arrangement of the carpus and tarsus in the condylarths and lemurs, and the same number of teeth in the primitive extinct lemurs as in the condylarths, can be better explained, it appears to me, as characters common to the ancestors of the Mammalia in general, than evidence that the lemurs and condylarths are closely related phylogenetically.

Having attempted to show that the Condylarthra cannot be

considered as ancestral to the Lemuroidea, it remains now to discover to which group of the Mammalia they are related. I have endeavored to prove that it is probably not correct to derive the lemurs from any of the forms bearing unguliform terminal phalanges, and that the Unguiculata is the group from which the lemurs have arisen. The Insectivora are by general consent acknowledged to be the most primitive group of the Mammalia, and it is in some generalised member of this order now extinct, that we must look for the ancestor of the Primates.

Now the placentation of *Tarsius*, as shown by Hubrecht, closely resembles that of the Insectivora, and both in the latter order and in the true Primates the placental area is very limited in extent, and thus differs widely from that of the lemurs, where the placenta is of the diffuse type. In man the chorion extends in an early stage of development around the whole embryo and is entirely villous. This represents to a certain extent the diffuse stage of the placenta of the lemurs. At any rate, on the criterion of the placenta, I see no objection to the view that the lemurs are related to the apes. The diffuse form of placenta of the lemurs has probably arisen from a non-deciduate restricted type, which would be also the ancestral form of placenta of the Anthropoidea. This is the view of the evolution of the placenta in the Primates as stated by Balfour (4).

In conclusion, the decidedly mixed character of *Tarsius*, relating it on one hand to the apes and on the other by so many characters to the lemurs, leads to the conclusion, that this genus approaches structurally the common ancestral type from which apes and lemurs have descended. If we do not grant this, then we are forced to the conclusion that the type of placenta found in *Tarsius*, the straight colon, and the closure behind and below of the orbit are all cases of parallelism, and that *Tarsius* is not genetically related to the apes. I am aware of the fact that it is quite the fashion of late to push the theory of parallelism to the extreme, with the result that we find few types that fit exactly in our phylogenetic series. Too much of this sort of thing would rather bear against the theory of evolution, as we would have innumerable parallel series, but few tending to convergence. I believe the characters of *Tarsius* that are like those of the Anthropoidea to be essential, and not adaptive. They prove that *Tarsius* is a true connecting link, genetically related to both lemurs and apes.

On palæontological grounds I cannot accept Leche's dictum as to the significance of the milk dentition in regard to the evolution of the lemurs, and it appears most probable that the ancestral lemur was a small insectivore-like animal, somewhat similar to *Tupaia*, an arboreal type, which had canines of the normal upright form, and larger than the incisors. In many of its characters this hypothetical ancestral type would more closely resemble *Tarsius* than any other living primate. I fully realise the fact that *Tarsius* is quite specialised in some respects; but as a whole it is decidedly primitive.

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III.

The Museums of Public Schools.[1]

III.—RUGBY.

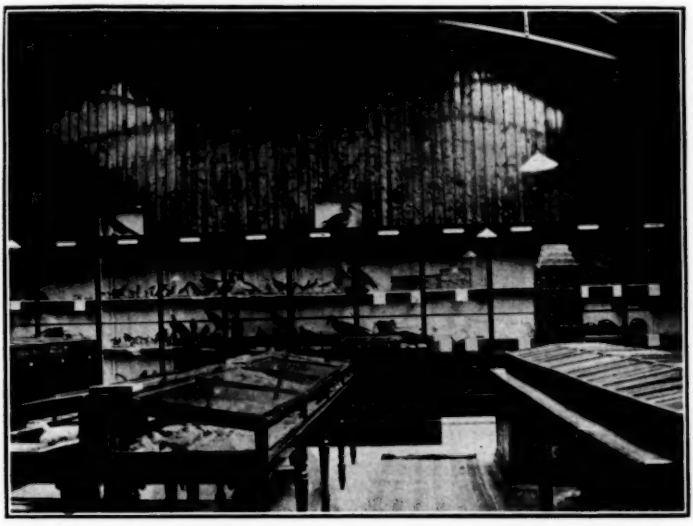
FOR the first beginning of a collection of natural history specimens in connection with Rugby School, we must go back 50 to 60 years. It appears that Dr. Arnold, the great Rugby headmaster, requested the boys of the school to bring back with them specimens of the common stones and fossils of their respective neighbourhoods. The boys answered this appeal with great alacrity, and a large heap of stones was the result. No attempt seems to have been made to label the specimens in any way, until Mr. J. M. (now Archdeacon) Wilson, on joining the staff of masters in 1859, took them in hand and examined them. A great many had been thrown away before that date, but there remained a very large number of specimens, most of them perfectly worthless, but a few score of some interest, and a few really valuable.

Mr. Wilson with the help of successive generations of pupils collected vigorously in the various brick-fields and lime-stone pits in the neighbourhood, and got together a good representative collection of the fossils of the local Lias.

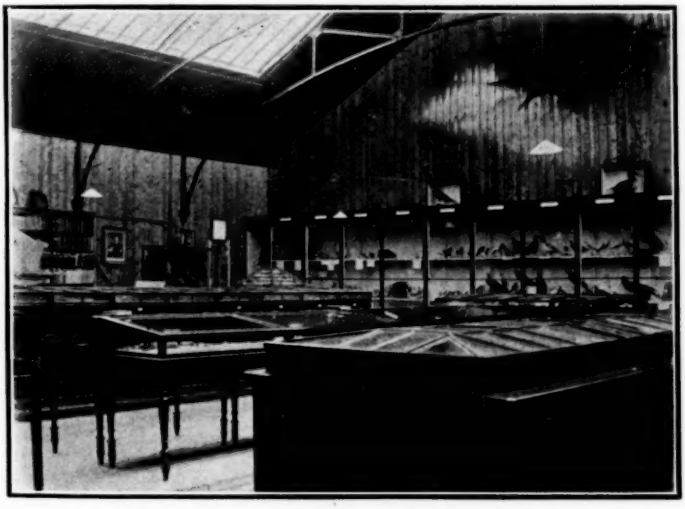
A little before 1859 one of the masters, Mr. C. T. Arnold, presented to the school a small collection of fossils, British and foreign, embracing types of the fossils found in the successive geological formations; to these were added a few local fossils, presented, it is believed, by the late Dr. Highton, then a master in the school.

These collections were, in 1859, all placed in a single case in the Arnold Library, the first School Library, built in memory of Dr. Arnold. To this collection Mr. Wilson added very largely, by collecting in the neighbourhood of Rugby and by gifts of series of specimens obtained elsewhere, including some from the Silurian, Carboniferous Limestone, Chalk, Greensand, Gault, and Eocene, as well as a collection of serpentines and granites from Cornwall. The collection soon outgrew its original case and filled the bookshelves of the adjoining section of the library; the table-case being then, and ever since, devoted to the strictly local collection.

[1] Previous museums dealt with in this series were: Charterhouse, vol. iii., p. 40, July, 1893; and Eton College, vol. vi., p. 201, March, 1894.



LOOKING TOWARDS THE SOUTH-EAST.



LOOKING SOUTHWARDS.

RUGBY SCHOOL NATURAL HISTORY MUSEUM.

In 1867 the Rugby School Natural History Society was formed under the presidency of Mr. F. E. Kitchener (late headmaster of the School at Newcastle-under-Lyne) who took charge of the botany, and began a botanical collection for the school. At the same time Mr. A. Sidgwick took up the entomology, and a collection of British Lepidoptera was commenced. Members of the school added to these, while collections of birds' eggs and fresh-water shells were formed by boys interested in them. These collections in the seventies were housed in a small room in the then new block of buildings abutting on Lawrence Sheriffe Street, while the geological collection, still under charge of Mr. Wilson, remained in the Arnold Library. These collections all grew apace by gifts from the boys and by gifts of specimens of all sorts, found in every quarter of the globe, from former members of the school.

During the headmastership of Dr. Jex Blake, the present Dean of Wells, a new Reading Room with Library accommodation was built, in memory of Dr. Temple (formerly headmaster, now Archbishop of Canterbury); a large number of books were removed to the Temple Reading Room from the Arnold Library, in which were left only a large collection of editions of the Classics and Divines not likely to be much consulted by the general mass of the school. The space thus set free was handed over to the Natural History Society, to which it proved somewhat of a white elephant, as no funds were provided for dealing with it, and the condition was made that the existing book-cases and furniture of the room should not be disturbed. However, boys and masters worked with a will, and the collections were transferred from their old narrow quarters and disposed on the shelves and floor-space assigned to them. This room, however, was never well adapted to the purposes of a museum, the book-cases being mostly ill-lighted and altogether too lofty to show to any advantage the objects placed upon them.

In 1892 increased accommodation for school purposes became a paramount necessity and Dr. Percival (then headmaster, now Bishop of Hereford) determined to use a portion of the Arnold Library for teaching the Sixth Form. At the same time he planned a block of temporary buildings, embracing accommodation for teaching physical science and music, together with a Natural History Museum. This block, occupying a portion of the headmaster's kitchen garden on the Hillmorton Road, was completed in the summer of 1894, and the collections belonging to the Natural History Society were immediately moved into it. This room, of which we give two views from photographs taken by members of the school (Plate III) has a floor-space of almost an exact square of 45 feet, and is entirely lighted from above. It is also ventilated by an open ridge extending through the whole length of the buildings almost exactly north and south. The heating is by hot water pipes running in gullies under the floor, the whole floor and wall space thus being made available for cases and book-shelves.

The southern end of the room is occupied entirely by a wall-case devoted to the zoology of the Vertebrata, designed and arranged by Mr. Collinge, of Mason College, Birmingham, and surmounted by a pair of antlers of the Irish elk found in County Tipperary in 1845 and presented to the school by the late Rev. J. P. Rhoades. These antlers were at that time the largest and finest which had been found in Ireland, but larger ones have since been found.

Along the east wall are book-shelves filled with books devoted to natural history. This library has been gradually and carefully selected, and is now fairly representative of the more popular side of the various branches of the subject. The rest of the wall-space is occupied by cases and cabinets. One case contains an admirably stuffed specimen of a badger, shot some years ago in the neighbourhood of Rugby, and set up with a model of its natural run. Another case is intended for a crystallographic collection in course of arrangement by a member of the school.

The north wall is similarly occupied by the entomological and other cabinets. On this wall is a case containing numerous specimens of exotic butterflies. The centre of the wall-space is occupied by the fossil remains of one of the large extinct New Zealand birds. On the same side stands a mummy, whose history is unknown to the present writer, and on whose genuineness many aspersions had been cast, until a photograph taken through the wrappings by means of the X Rays revealed the bones *in situ*.

The entrance door is in the north-west corner and the western wall is occupied by the cabinet containing a herbarium and two cases containing native Samoan clothing, presented by the Rev. S. H. Whitmee, a former missionary. There is also one of the "Magic Mirrors" of Japan, presented by Professor Sylvanus Thompson.

The floor-space is occupied by cases. One extending three-quarters of the length of the room contains the collection of local fossils whose history has been sketched above. Parallel to this, in the centre of the room, are two cases devoted to a purely educational geological collection, partly arranged by Mr. Collinge; while on the opposite side are a series of cupboards quite unarranged and containing the rest of the geological specimens. On the top of these cupboards is a table-case containing a type-series of Invertebrata, also arranged by Mr. Collinge. Crossing these on the south side is another series of cupboards, brought, like the others, from the Arnold Library, with a table-case on the top containing polished agates and other stones. Corresponding to this on the north side is another table-case of mahogany containing a series of minerals, most of which have been selected from the old dusty collections, arranged, and skilfully labelled by a present member of the school. These now form an excellent representative series of all the more common, and some rare, minerals, arranged on the basis of their chemical composition. Near this, in the corner of the room opposite the door, is a

model of the neighbourhood of Rugby extending four miles in all directions, on a horizontal scale of 4 inches to the mile and a vertical scale of 1 in. to 120 ft. This was originally projected by Mr. Wilson with a view to exhibiting some of the geological features of the district. The ground was surveyed by him and some of his pupils, and a plaster cast made, which for several years remained in the school-room occupied by him. When the natural history collections were removed to the Arnold Library space was found for the model, which, by the help of Mr. G. M. Seabroke (himself an old pupil of Mr. Wilson) and others, was worked over inch by inch and compared with the ordnance survey maps by means of proportional compasses, until it is now believed to represent with fair accuracy all the surface features of the district it embraces. It has also been painted, roads, streams, railways, canals being marked upon it and the sites of the villages shown.

Among various portraits on the walls is one of the late M. H. Bloxam, F.S.A., himself an old Rugbeian and all his life a devoted friend of the Rugby School Natural History Society. During his lifetime he presented to the school many treasures from his own valuable collection of books, pictures, and antiquities, bequeathing by his will many more. Although they find a more fitting home in the Art Museum, any notice of the Natural History Museum without mention of his name seems sadly incomplete to one who has watched the growth of the Society during the last twenty years.

Such are the chief features of the collections exhibited in the new Museum. Of course much remains to be done, but those who knew the collections as they were planted down in this Museum less than 30 months ago will admit that excellent progress has been made, and all who are interested in the development of a taste for natural history will join the present writer in the earnest hope that the succeeding generations of Rugby boys will not fall behind their predecessors in devoting part of their spare time to improving the various collections in this or that direction.

The president of the Rugby School Natural History Society, the Rev. R. Waterfield, has kindly permitted the use of the blocks for the two illustrations, which appeared originally in the Society's report for 1895. The writer is indebted also to Archdeacon Wilson for supplying him with information concerning the early history of the collections.

L. CUMMING.

IV.

The Suprarenal Bodies of Fishes.

DURING the past ten or twelve years a voluminous literature has appeared dealing with the structure and physiology of the suprarenal bodies of mammals; but it is only within the last few years that the attention of zoologists and physiologists has been directed to these structures in the lower vertebrates. The results of these investigations having proved of more than usual interest, a brief summary of the same may perhaps be useful.

The suprarenal bodies of mammals are situated one on each side of the body in close proximity to the kidney. Each consists of a 'medulla' or central portion and a 'cortex' or external portion, and is supposed to be a double internal secreting gland whose presence and functional activity is essential to life; for so far as is known at present from the researches of Abelous and Langlois, Tizzoni, Brown-Séquard, Cybulski, Schäfer and others, all animals die when these bodies are extirpated. In this connection, it is curious to note that suprarenal bodies have not been described in any but vertebrate animals.

I do not purpose entering in any detail into the question of the physiology of these bodies, a brief and useful summary having recently been given by Vincent (23).

Commencing with the Cyclostomata, the earliest reference to the subject is that by Rathke in 1827 (16) and again in 1828 (17). In 1834 Johannes Müller described a clustered gland in *Myxine*, which, however, seems to have been the pronephric portion of the kidney. In a recent paper (written in conjunction with Mr. Vincent) (4) I have reviewed in some detail the literature relating to these bodies in the cyclostomes, and have shown that as yet there is no satisfactory evidence of any suprarenal bodies in this group. Since the publication of the above paper, Pettit (15) has stated that he has found glandular structures which he thinks may be regarded as suprarenal bodies, but further evidence is yet wanting.

The earliest account respecting these bodies in Fishes is that given in 1819 by Retzius (18), who described them in certain species of dog-fish and skate. Stannius in 1839 (20) discovered similar bodies in teleostean fishes, and in 1846 (21) he gave a general account of them in elasmobranchs, teleosts, and the sturgeon. In the same year Ecker (7) verified Stannius' observations and gave a

description of the minute anatomy of the bodies. Hyrtl 1851 (10) and Leydig (11) contributed further papers to the subject, the former dealing with teleosts, and the latter with *Chimæra*.

In 1852 Frey (8) published a general *resumé* of what was known of these bodies, in Todd's Cyclopædia. Leydig in 1852 (12) pointed out their segmental arrangement; and a further contribution was made by Stannius. In 1875 Semper (19), in a very valuable paper, emphasised the importance of the segmental arrangement. F. M. Balfour in 1878 (1) gave an account of the morphology and development of the suprarenal bodies in elasmobranchs in his well known "Monograph." It is to this writer that we owe the term 'interrenal.' A description of the suprarenals of *Amiurus* was published by M'Kenzie in 1884 (14).

Coming now to more recent work and better methods of investigation, we find a series of papers by Fusari (9), Chevrel (2 and 3), Diamare (5–6), Pettit (15), and Vincent (22–25). The following short account of the suprarenal bodies is based upon the observations of the above five writers; and I am especially indebted to Mr. Vincent for his kindness in allowing me to read through a paged proof of his larger paper (26) as well as for copies of his other writings on the subject.

In the elasmobranchs the term 'suprarenal' has been applied to two totally distinct sets of organs, viz.:—(i.) the *interrenal bodies* of Balfour, which are somewhat rod-shaped bodies, sometimes paired, in which case they are situated on the internal dorsal backs of each kidney, and sometimes unpaired, lying in the median line on the posterior region of the kidney; and (ii.) the segmental series of bodies arranged in pairs on each side of the dorsal aorta, and in close relationship to the sympathetic nervous system, the *suprarenal bodies*.

The Interrenal body.—Among elasmobranchs this body is unpaired in the sharks, but paired in the rays. In the former group it is largest posteriorly, tapering anteriorly in the form of an ochre-yellow strip; sometimes there are *accessory interrenals* in the form of minute dots of similar substance. In the latter group these bodies are never quite symmetrical. Semper was of opinion that a connection existed between the interrenal and suprarenal bodies, but later investigations have shown that such a view was erroneous.

The Segmental Suprarenal bodies.—Chevrel (2) has figured and described the relations of these bodies with the sympathetic nervous system. In the elasmobranchs they are arranged in pairs in a more or less definite manner, from the Cuvierian duct to the posterior end of the kidney. The first pair are always the largest; posteriorly they become smaller and fragmentary. In the sturgeon they are similar in many respects to those found in elasmobranchs, only they are most plentiful in the anterior portion of the kidney. The sturgeon has only the cortex present, *i.e.*, the suprarenals here are equal to the interrenals of elasmobranchs and the known suprarenals (bodies of

Stannius) in teleosts. In the Teleostei the cortex only is present. The bodies are much fewer in number, usually two rounded or oval-shaped bodies of a pale pink colour, situated on the dorsal or ventral surface, usually in the posterior region, of the kidney. Sometimes they are imbedded in the substance of the kidney. Diamare (6), Pettit (15) and Vincent (25) have all described the suprarenal bodies of teleosts as usually being two in number. Writing of these organs in the Gadidæ, Mr. Vincent says (25, p. 58), "there is a considerable variation in number and size of the suprarenals, although their shape is nearly always rounded. As for number, two must be regarded as the rule, but there is even more variation in this respect than in the Pleuronectidæ. Thus, in a specimen of *Gadus morrhua* I have found as many as five; in *G. merlangus* I have found only one. I have occasionally found one also in *Molva vulgaris*. In *Merluccius vulgaris* I have found in one case as many as five; in this case the suprarenal of the left side was represented by four small bodies instead of one larger one. Their position is usually one on each side, but, as in other families, the right and left are rarely on the same level, one being usually anterior or posterior to the other. They also vary as to their relation to the middle line, some being more lateral, others more central. The suprarenals in this family are almost always visible on the ventral surface of the kidney, though they may (either one or both) be lateralised, or even exceptionally may be partially on the spinal surface. They are usually more or less imbedded in the kidney substance."

Similar statements to the above are to be found in the writings of other workers. I have merely quoted Mr. Vincent as being the latest.

In a dissection of *Gadus morrhua* now before me, I find in addition to the bodies mentioned above, numerous small bodies, varying greatly in size scattered throughout the substance of the kidney. I have isolated thirteen from the posterior region. Whether or not similar bodies are present in the substance of the kidney of other Teleosts I cannot now say; but the point is one deserving special attention from workers on this subject, as from their naked eye appearance these structures seem to be small suprarenal bodies, and might be termed *accessory suprarenals*.

In the Dipnoi, Pettit (15) has described the suprarenals, but he does not say whether the cortex and medulla are present. Vincent (22), from *à priori* considerations, had previously pointed out that suprarenals were "almost certainly present."

Thus, from the researches of Fusari, Diamare, Pettit, and Vincent we may draw the following conclusions:—

1. That suprarenal bodies are present in all fishes.
2. That the *interrenal bodies* of elasmobranchs correspond to the suprarenal bodies of teleosts, and to the cortex of the suprarenal bodies of higher vertebrates.

3. The *segmental suprarenal bodies* of elasmobranchs appear to be wanting in other orders of fishes (with the possible exception of Dipnoi), and correspond to the medulla of the suprarenal bodies in higher vertebrates.

From recent experiments made by Vincent (23–24) it would appear that these really correspond, physiologically as well as structurally. In teleosts the known suprarenal bodies appear to consist entirely of cortical substance, since they have no physiological action upon blood pressure, such as we know in connection with medulla; but that they are active secreting glands has been shown by Pettit (15). The same condition appears to obtain in ganoids.

In all higher vertebrates both portions are present, but combined in one organ, and it seems very probable that each part fulfils its own function, that of the medulla being to pour into the blood some material or materials which maintain the normal tone of the muscles throughout the body, while that of the cortex is yet unknown. Vincent (23, p. 6) has suggested that the function of the cortex is to manufacture and pour into the blood some substance which possesses the power of getting rid of pigments. He points out that in Addison's disease, "when this part of the gland is damaged the necessary secretion does not take place, and bronzing of the skin is the result."

One might form two conjectures concerning the function of the cortex:—(i) that it is in some way an accessory to the medulla, *e.g.*, that it prepares the material for final elaboration in the medulla; or (ii) that it is a totally distinct and independent gland, and its association with the medulla is merely accidental. From a consideration of the suprarenal bodies in the lower vertebrates, this latter view is the one I personally take; and I understand from Mr. Vincent that he also is inclined to agree with it.

The following table from my paper in the *Anatomischer Anzeiger* briefly summarises the distribution of the cortex and medulla in the Cyclostomata and Pisces as known at present.

	Suprarenals.	
	Cortex.	Medulla.
Cyclostomata	Possibly degenerate.	
Elasmobranchii ..	Interrenal	Paired suprarenals
Holocephala	do.	do.
Ganoidei	Suprarenals in kidney ..	Apparently absent
Teleostei	Suprarenals on kidney ..	do.
Dipnoi	No suprarenals as yet described. Perirenal large-celled adenoid tissue? (Vincent, 22). Certain bodies described by Pettit (15).	

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V.

Numerical Variation of Parts in Ranunculus repens.

THE following paper was submitted to us by a friend, not for publication, but as an example of the kind of work that can be done by one having only an elementary knowledge, but with his energies turned into profitable channels. Considering the importance now attached to the study of variation, none will deny that this account of actual facts is a useful, though a small, contribution. The writer is one who has but little time at his own disposal, and the most limited facilities for the study of either natural history or science. We have therefore obtained permission to publish this first essay of his as an encouragement to others in a similar position. It would not, perhaps, be altogether waste of time if series of *Ranunculus repens* from other parts of the country were examined in the same way, and the results compared with those of Mr. Pledge. At all events, both in zoology and botany, there are abundant opportunities for those who are not satisfied to remain "mere collectors."—Ed. NAT. SCI.

The 500 specimens examined were kindly supplied by Miss K. M. Hall, curator of Whitechapel Public Museum, since my occupation prevented me from collecting them myself. They were all obtained from one locality. It may be interesting to note that the sum-total of all the parts counted, viz., the sepals, petals, stamens, and carpels of 500 specimens, amounted to 50,642, averaging over 100 pieces to each specimen tabulated.

The method employed in the investigation was as follows:—Four separate sheets of square-ruled paper were used, one sheet for sepals, one for petals, and one each for stamens and carpels. Each specimen done was numbered, the number being the same on all four sheets, thus rendering it easy to ascertain the particulars of the variation in each whorl of any given specimen.

The floral formula, calculated from the data obtained, is:—Sepals, 5·004; Petals, 5·672; Stamens, 54·534; Carpels, 36·074. Taking it as 5, 5, 54, and 36 respectively, not one specimen in the whole 500 conforms to it. If taken as 5, 6, 55, and 36, however, there is one specimen (No. 433) in agreement. So that practically the formula thus obtained is purely a mathematical conception and has no real existence.

Sepals.—Fig. 1 shows the variation in the Calyx, each dot representing 10 individuals. The actual numbers are:—

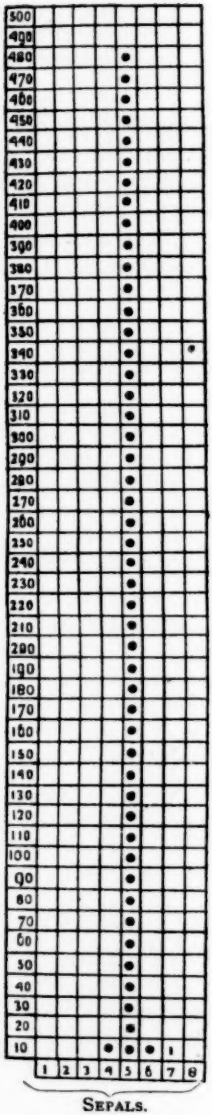


FIG. 1.—Variation in Sepals of 500 specimens.

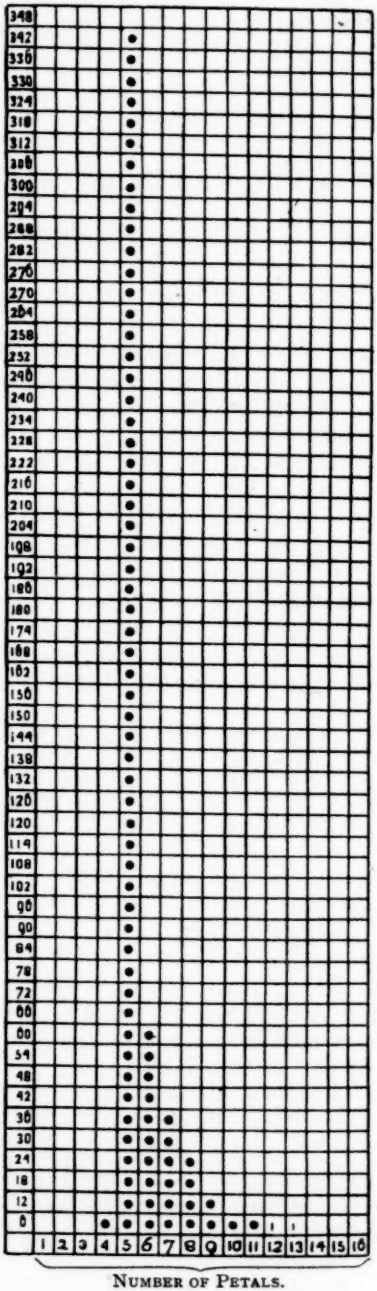


FIG. 2.—Variation in Petals of 500 specimens.

Specimens with 4 sepals	9
,, ,, 5 ,, ...	481
,, ,, 6 ,, ...	9
,, ,, 7 ,, ...	1

In the nine cases with four sepals there was a re-adjustment of symmetry, the sepals being arranged at right angles to each other.

Appended is an analysis and summary of the 19 cases of variation, from which one sees that in the cases with four sepals the means of petals and stamens are above the average, and that of the carpels somewhat below. In the instances of six sepals all three means are considerably above the average; and, finally, the means of all the four variations are also all above the average. It appears, therefore, that each whorl varies independently.

ANALYSIS OF 19 VARIATIONS IN THE CALYX.

	With 4 sepals.			With 6 sepals.		
	10 petals.	64 stamens.	45 carpels.	6 petals.	61 stamens.	49 carpels.
	7 ,,	62 ,,	43 ,,	8 ,,	63 ,,	46 ,,
	6 ,,	49 ,,	27 ,,	5 ,,	71 ,,	43 ,,
	6 ,,	50 ,,	39 ,,	6 ,,	68 ,,	38 ,,
	5 ,,	62 ,,	29 ,,	5 ,,	63 ,,	39 ,,
	5 ,,	45 ,,	42 ,,	6 ,,	55 ,,	34 ,,
	6 ,,	36 ,,	25 ,,	11 ,,	48 ,,	42 ,,
	5 ,,	39 ,,	25 ,,	10 ,,	43 ,,	37 ,,
	5 ,,	58 ,,	25 ,,	8 ,,	41 ,,	27 ,,
	55	465	300	65	513	355
Mean	6·1	51·6	33·3	7·2	57·0	39·4

With 7 sepals:—5 petals, 64 stamens, 45 carpels.

Petals.—(Fig. 2). In this diagram each dot represents six specimens, the actual numbers being:—

Specimens with 4 petals	7
,, ,, 5 ,, ...	345
,, ,, 6 ,, ...	60
,, ,, 7 ,, ...	36
,, ,, 8 ,, ...	24
,, ,, 9 ,, ...	13
,, ,, 10 ,, ...	6
,, ,, 11 ,, ...	7
,, ,, 12 ,, ...	1
,, ,, 13 ,, ...	1

In the case of a batch of 34 specimens (Nos. 337–370 inclusive) analysed on p. 328, the mean number of petals is as high as 7·8, the mean of their sepals being 5·0, of stamens 44·3, and carpels 29·3. In this case the petal whorl (corolla) appears to have increased at the expense of the stamen and carpel whorls. Such exchange is apparently not general, at least to any marked extent, but the number of members of any given whorl varies, as previously stated, independently of the others.

Stamens.—(Fig. 3). The chief point to note in this diagram is the fair regularity of the curve, the recorded maximum, 55, closely agreeing with the calculated mean, 54·534.

Carpels.—(Fig. 4). Among other points of interest in this diagram, the first to be observed is the extreme irregularity of the

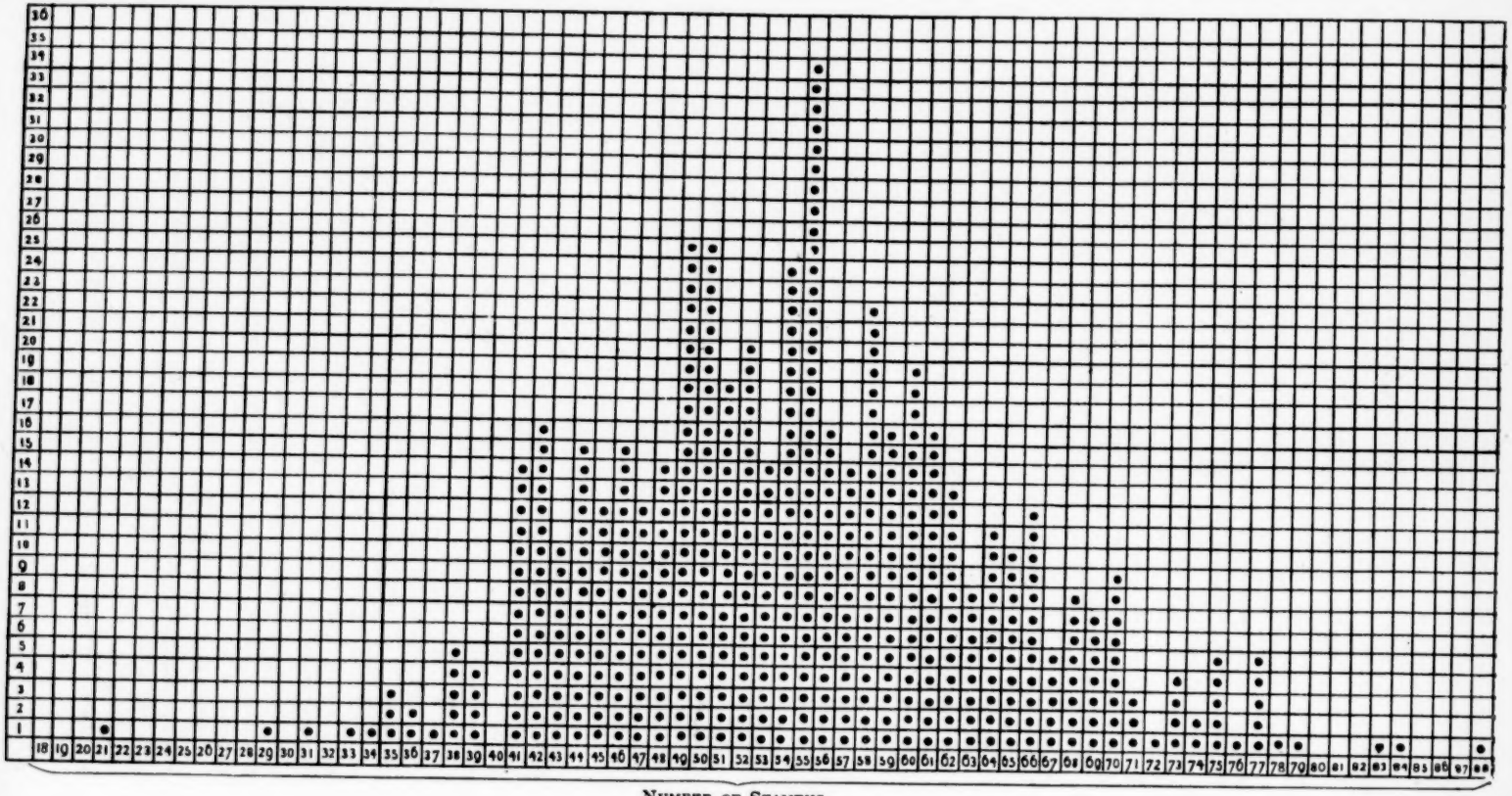


FIG. 3.—Variations in Stamens of 500 specimens of *Ranunculus repens*.

Each dot represents one individual.

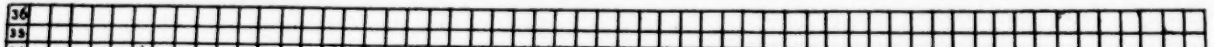
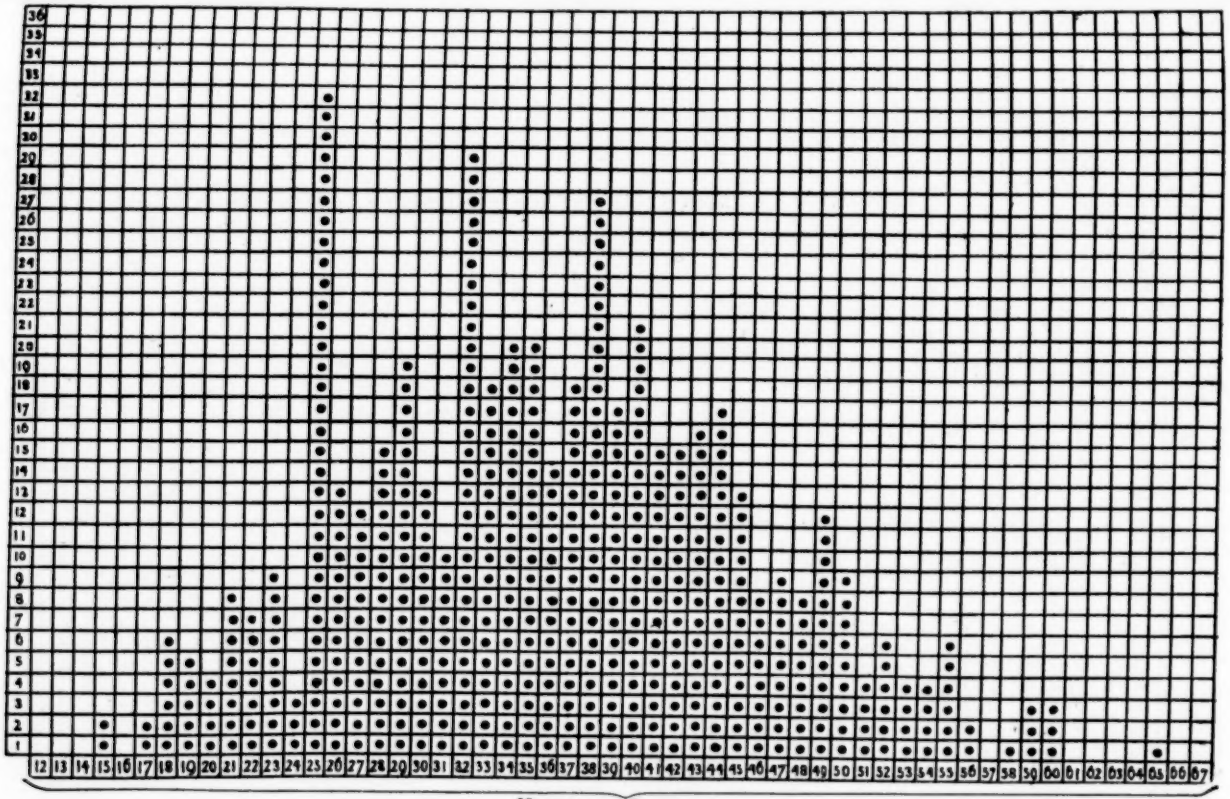


FIG. 3.—Variations in Stamens of 500 specimens of *Ranunculus repens*.

Each dot represents one individual.



NUMBER OF CARPELS.

FIG. 4.—Variations in Carpels of 500 specimens of *Ranunculus repens*.

Each dot represents one individual.

curve, in strong contrast to the last. The maximum is at 25 and the calculated mean 36·074. There is, however, a secondary maximum at 32, and a tertiary one at 38. If from the diagram of the stamens (Fig. 3) there are deducted those dots whose numbers have, in Fig. 4, made the curve imperfect, that is to say, the last or highest 21 of the 25 carpels column, the last 2 of the 29 column, and the last 10 of the 32 column, then the stamen curve remains practically the same. The deductions are fairly distributed on each side of the maximum and not localized at all, showing that here also the whorls vary independently.

Analysis of Certain Specimens,

Number.	Sepals.	Petals.	Stamens.	Carpels.
337	5	11	42	45
338	5	11	44	39
339	5	13	42	38
340	5	10	50	42
341	5	8	38	27
342	5	6	45	21
343	5	9	41	40
344	5	5	49	31
345	5	5	55	31
346	5	6	41	20
347	5	10	34	29
348	5	9	42	26
349	5	11	43	43
350	5	11	39	37
351	5	5	61	20
352	6	10	43	37
353	5	5	54	26
354	5	10	43	32
355	5	5	51	26
356	5	5	42	22
357	5	5	50	23
258	5	5	49	15
359	5	8	41	26
360	5	8	47	36
361	5	5	49	29
362	5	5	48	20
363	5	5	43	25
364	5	12	38	32
365	5	11	44	41
366	6	8	41	27
367	5	8	21	26
368	5	8	41	26
369	5	7	53	25
370	5	6	45	45
Mean	5·0	7·8	44·3	29·3

There being so few members of the calyx and corolla, I would suggest that, if there were more, there would be greater variation; that is, given a greater range of variation, the chances would be against such a high maximum occurring then as now.

As regards the irregularities in the curves of the stamens and carpels, is it probable, that, if a much greater number of specimens (say 10,000) were examined, these curves would become more regular; or should these figures be taken as fairly representative?

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SOME NEW BOOKS.

Moths and their Classification.

The Lepidoptera of the British Islands. By Charles G. Barrett. Vol. iii. Heterocera, Bombyces, Noctuæ. 8vo. Pp. 396. London: L. Reeve & Co., 1896. Price 12s. (Large paper edition with coloured plates. Price, in parts, £3).

A Handbook to the Order Lepidoptera. By W. F. Kirby. Vol. iii. Pp. xxvii., 308, 26 coloured plates and many figures in text. Vol. iv. Pp. 246, 31 plates. 8vo. Allen's Naturalists' Library. London: W. H. Allen & Co., 1897. Price 6s. each.

Monograph of the Bombycine Moths of America North of Mexico. Part ii. Family I.—Notodontidæ. By Alfred S. Packard. 4to. Pp. 292, 49 pls., 9 maps, and 88 figs. in text. Philadelphia: National Academy of Sciences, vol. vii., first memoir, 1895. Received March 13, 1897.

Two years elapsed between the notices in Natural Science of the first and second volumes of Mr. Barrett's work. It is satisfactory to be able to review the third volume seventeen months only after the second. The author has now given us the remaining families of the "Bombyces"—the "Bombycidæ," Endromidæ, Saturniidæ, Drepanulidæ, and Notodontidæ; and the first instalment of the "Noctuæ"—including the Cymatophoridæ and four genera of the trifid Noctuidæ.

In commenting on Mr. Barrett's second volume, we expressed regret that he had adhered to that old classification of British moths which has been so largely amended by modern workers. In the present volume it will be noticed that he adheres to Stainton's plan of classing the Cymatophoridæ with the Noctuidæ on account of "the structure and usefulness of the tongue, their love of sweet substances as food and their crepuscular flight." These, however, are adaptive characters which cannot be allowed much weight as indications of true affinity. In the more recent classification of Staudinger the Cymatophoridæ are placed among the "Bombyces"; but this group must now be considered quite untenable as a natural assemblage of families. It might possibly be better to abandon all divisions of the Lepidoptera between the order and the family, and we should then see the Cymatophoridæ in their natural position between the Notodontidæ and Noctuidæ. The genus *Asteroscopus* or *Petasia*, which is now usually regarded as noctuid, is retained by Mr. Barrett among the notodonts.

Mr. Barrett keeps the name "Bombycidæ" for the first family dealt with in this volume, although he rightly uses *Lasiocampa* for the genus of eggar moths, which many British entomologists erroneously call "*Bombyx*." The latter name belongs properly to the common silkworm; the true Bombycidæ are unrepresented in the British fauna, and the eggar family should be known as Lasiocampidæ.

Mr. Barrett's description of our commonest *Lasiocampa*—*L. quercus*—is of exceptional interest. He does not consider that the

small, dark, northern race *L. callunæ* has any claim to be considered a distinct species, pointing out, among other facts, that in Wales the males of *L. callunæ* pair with females referable to typical *L. quercus*. There are, however, instances of nearly allied forms, which, though they interbreed where their ranges overlap, are considered good species, *e.g.*, the carrion and hooded crows. Mr. Barrett gives a lively account of the "assembling" of male moths of *L. quercus* around a captive female, "some flying steadily to the spot and fluttering or running all over the place in which the female is hidden . . . or sweeping backwards and forwards in wide beats; while others go quite frantic, dash themselves on the ground and spin on their heads." There is also a vivid description of a flock of males trying to cross the ridge of Hindhead in the teeth of a strong gale. Mr. Barrett watched the moths work their way up a sheltered hollow to the summit, only to be "instantly carried back over the valley, and so tumbled ignominously down, to renew the strife with the same ill-success." The student of bionomics will also find interesting matter among the notodonts in Mr. Barrett's account of the protective resemblance and mimicry of the "Puss" and "Lobster" moths—*Curtula vinula* and *Stauropus fagi*—and their caterpillars, insects rendered so familiar to naturalists by the writings of Professor Poulton and other students of animal colour and form.

There are only four genera of noctuid moths dealt with in the present volume—*Diphthera*, *Acronycta*, *Arsilonche*, and *Agrotis*. We are glad to see that Mr. Barrett is going to favour us with a new classification of the British noctuids; the arrangement of genera with which our entomologists have so long been content places closely-allied species in different "families." Mr. Barrett writes wisely on the difficulty of finding reliable structural characters for the differentiation of these insects. They are a large and dominant family, probably still in process of comparatively rapid evolution, and hence the difficulty which the naturalist experiences in dividing them up into generic groups. In dealing with the *Acronyctæ*, Mr. Barrett has largely availed himself of Dr. Chapman's well-known studies of the early stages. It is a pity that so few references are given to the papers whence these and other particulars are taken, for one must hope that some of Mr. Barrett's readers will wish to consult the original memoirs. The next volume of the work will bring out the author's views on the noctuids more fully. We notice that he eschews names for varieties and aberrations in dealing with the very variable species of the large and important genus *Agrotis*, but he gives a succinct account of the principal types of variation in such species. *A. aquilina*, by most recent students considered a form of *A. tritici*, is retained by Mr. Barrett as a "good" species. In dealing with the varieties of *A. tritici*, the author points out how the different forms tend to "mimic" various species of *Agrotis* and other noctuid genera. This fact is very suggestive as throwing light on the problem of mimicry generally. In nocturnal insects like the agrotids, no advantage to the individual can be supposed. But the fact that one species may vary so as to resemble half a dozen others suggests a starting point from which—in day-flying insects—one or more mimetic forms might be preserved and the rest eliminated by the action of natural selection.

As in the previous volumes, the specific descriptions of the moths and their preparatory stages are very good. We notice with regret, however, that synoptical tables such as Mr. Barrett gave in his early volumes are altogether wanting in the present one. The

descriptions of families and genera, too, are very meagre, and, in most cases, quite insufficient for purposes of determination. This may not be a matter of so much importance in the edition with the coloured plates, if the student's only object is to name his insects, but it renders the small edition well-nigh useless to beginners for that purpose. In most of the reviews (in NATURAL SCIENCE and elsewhere) of previous volumes of Messrs. Reeve's series of works on British insects, complaint was made that not even an advertisement in the small edition informed the reader that there was also an issue with coloured figures. At the end of the present volume is a general catalogue of Messrs. Reeve's publications in which will be found an announcement that volumes i. and ii. of the present work were issued in both forms. It may be inferred from this, on the principle of analogy, that a similar course has been adopted with regard to volume iii.

Mr. Kirby's volumes form part of a manual on the moths and butterflies, in which the author's aim is to make the study of British species introductory to that of the Lepidoptera of the world. It was intended to include all the butterflies in the first two volumes, but pressure of space in them has led to the third, now before us, commencing with an account of the Hesperiidæ or "skippers"—generally considered the lowest butterfly-family. As Mr. Kirby points out, the old, primary division of the Lepidoptera into butterflies and moths cannot be maintained; and although he places the Hesperiidæ under the heading "Rhopolocera," he states his opinion that if any line between "butterflies" and "moths" can be drawn, that family should be classed rather with the moths than with the butterflies.

In the classification of the Hesperiidæ, Mr. Kirby follows Capt. Watson's revision. The more typical genera are described, with one or two species of each, all the British species being figured; there are also short accounts of the eggs, caterpillars and pupæ, and the ranges of the insects are in most cases indicated. In discussing the general distribution of the family, Mr. Kirby points out that "skippers" are relatively much more abundant in North America than in Europe, though numerous in the tropics of both hemispheres, and that these insects are unrepresented in Greenland where nymphalid, lycaenid, and pierid butterflies occur.

The greater part of the volume is devoted to certain families of moths. In this and the succeeding volume it is intended to complete the "Sphinges" and "Bombyces." Mr. Kirby's arrangement of the families closely follows that which he adopted in the first volume of his "Catalogue of Lepidoptera Heterocera." In the present volume twenty-six families are dealt with; the principal being the Castniidæ, Uraniidæ (Cydimonidæ), Agaristidæ, Chalcosiidæ, Zygænidæ, Arctiidæ, Lithosiidæ, Hypsidæ, Lymantriidæ (Liparidæ), Psychidæ, Limacodidæ, and Notodontidæ. Several new families are suggested by Mr. Kirby for isolated or aberrant forms. The family Euschemonidæ is proposed for the single Australian species *Euschemon Rafflesiæ*, a curious insect which has been classed by different authors with the butterflies and with the moths. Another moth which receives the distinction of a family to itself is the West African *Pseudopontia paradoxa*, one of the most puzzling of insects, classed by most German writers with the pierid butterflies, but showing by its wing-neuration some affinity to the chalcosiid moths.

The great majority of the coloured figures are good, yet one is tempted to ask why are moths so often drawn without legs? A fair number of species are figured in the present work for the first time,

preference being given to unfigured insects when new plates were thought desirable. On this account alone the book will be valuable for reference. Most of the British species are mentioned and figured and the more important foreign genera are noticed. In some cases particulars of the early stages of the exotic forms make a welcome addition. A plate is devoted to metamorphosis of the large South American psychid moth, *Oiketicus Kirbyi*; but there is unfortunately only a very meagre account of the British species of this most interesting family. Throughout the volume, an altogether disproportionate amount of space has been devoted to the synonymy and references of the species which are mentioned; in many cases these take up as much space as the account of the insect itself, and sometimes more room is allotted to a list of names and books than to the description of the moth, its haunts, and its habits. These are consequently passed over very summarily and the important question of variation is often not mentioned at all. It would be ungracious to complain of omissions in a book covering so wide a field, were it not that nearly a whole page is at times devoted to matter proper to a catalogue.

Mr. Kirby is so high an authority on questions of nomenclature that it is impossible not to give respectful consideration to the alterations in familiar names which he thinks necessary. But we surely might be allowed to retain a well-known name like *Urania* which is pre-occupied only in botany. And the suggested transference of the specific name *lubricipeda* from the buff to the white ermine moth would cause well-nigh intolerable inconvenience. Linné called both species *lubricipeda*, distinguishing the buff insect, which has borne the name unquestioned for more than a century, by the addition of the letter *β*. To make the law of priority so "stern and unbending" that a single letter causes such confusion in nomenclature as this, will ensure the continual disregard of that law by the majority of working naturalists.

In the fourth volume of Mr. Kirby's book the systematic portion is comparatively short, comprising only the Sphingidæ, Bombycidæ, Saturniidæ, Drepanulidæ, Lasiocampidæ, Zeuzeridæ, Hepialidæ, and a few small families. The rest of the volume is occupied with valuable essays on the classification and bibliography of the Lepidoptera. We are told in the preface that these were to have been issued in the fifth (last) volume of the series, but they are included in the fourth in order to avoid dividing the systematic account of the noctuid moths into two instalments.

Some of the most attractive of all moths, such as the hawk-moths and the silk-producing insects, are here dealt with, and it is satisfactory to notice that more space is given to description and less to references than in the preceding volume. Still, it is disappointing, after nearly half a page devoted to the literature of *Lasiocampa quercus v. callunæ*, to find no word as to how that insect differs from the type. All the British species are described and figured, together with typical exotic forms; the caterpillars—in these families often very striking in colour and form—receive a fair amount of attention, but it is surprising to find no figure of the common silkworm. And, in describing the larvæ of the hawk-moths, some reference might, with advantage, have been made to the supposed biological import of the two forms of caterpillar (brown and green) occurring in so many of the species, of the series of side-stripes on the caterpillars of the sphingids, and of the large 'eyes' on those of the choerocampines.

The essay on the literature of the Lepidoptera, which concludes

the volume, is a useful and valuable piece of work. Mr. Kirby specially insists that it is far from being exhaustive; it would be ungracious therefore to point out omissions, but it may be stated that the essay deals almost exclusively with the systematic and faunistic aspect of the study of moths. After mentioning the more important authors dealing with Lepidoptera in general, from Linné onwards, Mr. Kirby furnishes references to the works which treat of the fauna of special countries, arranged under the recognised zoological regions.

In the introductory essay, Mr. Kirby gives a summary of the more important schemes of classification which have been proposed for moths, beginning with the tenth edition of the "Systema Naturæ." From the works of Fabricius, Schiffermüller, and Hübner, the reader is led on to the systems of Stephens, Herrich-Schäffer, Boisduval, Guenée, and Walker. For this last writer Mr. Kirby has a good word to say:—"his work, like that of other authors, differed much at different times, and is by no means deserving of the sweeping and wholesale condemnation it has received at the hands of many whose own work is far from faultless." Coming then to modern writers, Mr. Kirby deals briefly with the classifications of Snellen, Hampson, Meyrick, and Comstock, founded mainly on the structure of the imago, with Dyar's scheme based on the form of the larva, and Chapman's on that of the pupa. The researches of these writers, which have been often referred to in the pages of NATURAL SCIENCE, have in many respects transformed the older views as to the affinities of the families of moths.

The last classification mentioned by Mr. Kirby is that suggested in Professor Packard's elaborate memoir, a copy of which we have just received. Though the title suggests only a monograph of North American notodonts, there are a series of introductory essays, of which the most important deals with the classification of the Lepidoptera as a whole. Comstock divided the order into two primary divisions, the Jugatæ and Frenatæ, the former of which includes two families, the Micropterygidæ and Hepialidæ, characterised by the presence of a jugum or fold of membrane on the inner margin of the forewing. This structure, which occurs in the Trichoptera or caddis flies, is unknown in all other moths, and Comstock therefore regarded the two families named as forming a primary archaic division of the Lepidoptera. A similar view is held by Hampson, Meyrick, and Grote, the neuration of the hindwings in these families agreeing with that of the forewings, while in all other moths the number of nervures in the hindwings has become reduced. Packard, however, considers, with Chapman and Tutt, that the mouth-organs of the imago and the structure of the pupa are of greater importance than the form and neuration of the wings. He agrees with Chapman's division of the old genus *Micropteryx* into two families—the Eriocephalidæ and Micropterygidæ; and pointing out that the tiny moths included in the former of these have mandibles not reduced to a vestigial state, and maxillæ in which the typical parts of those jaws as developed in the lower insect-orders can be recognised (an observation first due to Walker) he ranks them as the primary archaic division of the moths (Lepidoptera laciniata) and sets over against them all the other insects of the order (Lepidoptera haustellata). Then he divides this latter section also into two very unequal groups. The Micropterygidæ (*sens. str.*), whose pupæ have limbs entirely free, like those of a caddis-fly pupa, and large functional mandibles, form the group Paleolepidoptera, while all the other families are united in the group

Neolepidoptera, which again is divided, mainly on the lines suggested by Chapman, into a lower series of families with incomplete, and a higher series with obtect, pupæ.

A specially valuable section in Packard's work is his description with figures of a number of larvæ and pupæ of tineoid moths, which he considers worthy of division into ten or fifteen families. He gives in conclusion a tentative genealogical tree (copied in Mr. Kirby's work). A comparison of this with the genealogy given in the first volume of Hampson's "Moths of India" is interesting and suggestive. Though there are numerous divergencies in points of detail, both writers agree in placing the Saturniidæ, Noctuidæ, Agaristidæ, Geometriidæ, Sphingidæ, and Notodontidæ higher than most of the old group Bombyces, and both agree in the near affinity of several "bombycine" families—as the Cossidæ, Sesiidæ, and Zygaenidæ—with the so-called "microlepidoptera." Packard includes the butterflies in his tree, and derives them through the Castniidæ from the Hypsidæ. This view cannot be maintained in face of Chapman's recent work on the pupæ of butterflies, which shows the origin of the group from low lepidopterous forms independently of the higher moths.

The sections of Professor Packard's memoir which deal specially with the North American notodonts are worthy of the highest praise, and should act as a stimulus to British workers to investigate their own insect fauna in an equally thorough style. The species are described at length, in most cases in all their stages, and are excellently illustrated with coloured plates and structural figures. The only unsatisfactory feature in the illustrations is to be found in many of the photographs of moths from actual specimens; the results of this process are often indistinct and the figures would be nearly useless for purposes of identification. Specially valuable are the detailed accounts of life-histories; and, in a very suggestive introductory essay on the incongruence between the larval and adult characters, the author points out how in a certain species of a genus, the caterpillar may become vastly modified in its later stages, while the imago agrees closely with that of an insect whose larva retains primitive characters throughout its growth. From some of the modifications, believed to be primitively adaptational, which occur regularly at a certain stage in the life of a caterpillar, the author argues for the inheritance of acquired characters.

In his essay on the distribution of the notodonts Professor Packard objects to the term "Nearctic" of Sclater as well as to "Sonoran" of Merriam. He divides North America up to and including Merriam's Transition zone into four provinces: the Appalachian (N.E. and Central States—S. Canada) Austroriparian (S.E. and Gulf States) Campestrian (West Central and Pacific States) and Mexican. There are eleven genera found in the eastern provinces which are absent from the Campestrian, while no genus is peculiar to the latter province. Nine genera are common to Eurasia and North America, eight are peculiar to North America, while only five are common to North and South America. It is of interest to note that while most of the genera common to the Old and New Worlds are characteristically northern in America, none of the eight peculiar North American genera range northwards beyond Merriam's Transition zone. The division of the insects into a Holarctic and a Sonoran fauna would thus appear to be justified.

GEO. H. CARPENTER.

A Study in Variation.

On Mechanical Selection and other Problems. By Karl Jordan. Pp., 110., iv. plates. (From *Novitates Zoologicæ*, vol. iii. Tring: 1896.)

This memoir is the record of a careful and valuable piece of research which throws light on some factors of organic evolution. Dr. Jordan has compared the variation of the genital armature in a number of species and sub-species of butterflies (*Papilio*, auctt.), with the variation of the wing-patterns, and has been able to formulate several suggestive generalisations from the facts established. Incidentally he discusses many current problems.

In his introductory remarks, the author ventures to answer a question more easy to ask than to solve. "What is meant by a species?" He criticises the definitions of the term which have been given by Eimer, Romanes, and Wallace, and concludes that "the chief criterion of specific distinctness of a given form of animal or plant is the impossibility of fusion with other forms." There comes a point, according to Dr. Jordan, in the development of races, when, a certain degree of divergency having been attained, "the form exhibiting this divergency can never become one with any other form." All distinctions short of this point are treated as varietal or sub-specific, and these lesser divisions are held by the author to differ from the true species, not only in degree but in kind. Even granting that there is a point of divergence past which fusion becomes impossible, doubt as to whether certain forms have or have not gone beyond it must always remain until set at rest by experiment; so that there will be room for differences of opinion among those who accept Dr. Jordan's conception of the species. But not every naturalist will agree with his premise that the course of evolution must be represented by a tree with constantly dichotomous branching. "If we should have to concede the possibility," he writes, "that the lines of ancestors of any two forms of plants and animals, say of the lion and the giraffe, were such that they first became widely divergent, then identical, then again widely divergent, not only the figurative tree, but also the kind of evolution it is meant to illustrate, would be pure nonsense." The lion and giraffe are rather extreme examples, but the opinion that lines of descent might converge or anastomose as well as diverge would not be summarily set down as "pure nonsense" by all who have thought on the subject.[1]

Dr. Jordan adopts the trinomial form in naming the sub-species with which he deals, and in cases where the name first given to an individual of the species is evidently applicable to a particular sub-species he holds that that name must be repeated to distinguish that subspecies, *e.g.*, *Papilio priamus priamus*. Sometimes indeed the specific name has been applied to a particular form of one sex in a polymorphic sub-species; then we get *Papilio polytes polytes* ♀ .-f. *polytes*. "The meaning of this name is exclusive and hence precise, and that is the highest praise we can give to a name." It will be re-assuring to those not enthusiastic over such results of advanced nomenclature, to know that not many butterflies have to be labelled after that fashion.

The parts whose variation is particularly described are the *harpes*, or series of ridges, teeth, and hooks to be found on the inner surfaces of the paired valves or claspers, which are lateral wings of the ninth abdominal segment in male butterflies. Detailed descriptions and

[1] Cf. E. W. McBride, Nat. Sci., vol. x., p. 31. Jan., 1897.

figures of the varying forms assumed by these harpes in different individuals of the same species and sub-species are given, and enough material has been examined to lead to the conclusion that there is no correspondence between the variation of these organs and the variation of the wing-patterns on which the sub-species are founded. The relative length of the prehensile section of the harpe differs to the extent of 73 per cent. in *Papilio machaon*. The *uncus*—or dorsal hook belonging to the tenth segment—of the British forms of this butterfly is closely like that of the Japanese sub-species and different from the forms found in continental European and Asiatic insects. Similar differences are noticed among the races of eastern species which Dr. Jordan has examined, and a division of a species according to the genital armature would, in most cases, give quite a different set of sub-species from that which has been established on the patterns of the wings.

Though the amount of variation in the harpes is generally considerable, there are for each species limits which are not overstepped, and the author therefore considers these organs of the greatest use for the determination of true specific differences. It is certain, however, that many of the various forms within certain species figured by Dr. Jordan would be considered of specific value by systematists unacquainted with the amount of variation which may occur. An investigation into the limits of divergence seems therefore necessary before the use of these organs as specific characters can be relied upon. But the comparative constancy of the genital armature within each species has an evident bearing on the development of the race. Dr. Jordan has made some observations on the corresponding organs of female Papilios and finds a set of variable ridges and furrows on an intersegmental membrane, in each case adapted to be held by the harpe of the male clasper. He infers that, by a process of mechanical selection, the variation of the genital armature in both sexes must be kept within limits, because individuals with abnormal organs would be incapable of copulation. And it follows that any considerable modification of the armature, generally affecting both sexes of a race, would lead to practical isolation and accelerate the formation of a new species. The author quotes a passage from the "Origin of Species" in which Darwin dwelt on the difficulty of accounting for the infertility of "natural varieties, as soon as they have been permanently modified in a sufficient degree to take rank as a species." The facts dealt with in the present memoir show at least one way in which such segregation as Romanes' theory of physiological selection was proposed to explain, might be produced; though "the cause of infertility would not be physiological diversity but mechanical impossibility of fertilisation." The importance of the principle here invoked has been long recognised by various naturalists, and on p. 48 of the current volume of NATURAL SCIENCE, Mr. O. H. Latter quotes an observation of Dr. Marchal, bearing on its importance in wasps.

Dr. Jordan is careful to point out that mechanical selection can only work on variations produced by other factors. No direct evidence as to these other factors is furnished by his researches, but some incidental remarks are worth notice. There is an Indo-Malayan butterfly, *Euplœa rhadamanthus*, mimicked by a *Papilio*, *P. caunus*, and both these species have distinct forms in Sumatra, Java, and Borneo, separable only by minute differences in the extent of the white markings on the wings. As the author points out, it is hard to believe that such minute variation in the mimicking species can be the result of natural selection; even one who considers natural

selection the true explanation of mimicry generally would admit that. The similar variation in the same locality of two species of different families, but with the same wing pattern, tells in favour of the direct action of the local surroundings on the markings. And the same view is upheld by the facts as to the geographical distribution of some of the sub-species considered. A variable species may give rise to two similar or closely allied sub-species in widely-separate localities; the Ceylonese form of a butterfly may be closer to the Indo-Malayan than to the continental Indian form. To invoke land-connections to explain the ranges of sub-species is less reasonable than to suppose—as we know by experiment may be the fact—that similar conditions may induce similar variations in distant localities. But if any sub-species may in course of time develop into a true species, it follows that the same species might arise independently in two or more separate localities.

Dr. Jordan is content to class himself with the classifiers; in more than one passage he refers to the work of "us systematists." This memoir shows clearly how much biological importance the careful study of species may have, and should encourage his fellow-systematists to fresh and more painstaking effort by reminding them of the many unsolved problems that still lie behind the dry labour of the species-maker. GEO. H. CARPENTER.

BRITISH HOMOPTERA.

THE HEMIPTERA HOMOPTERA OF THE BRITISH ISLANDS. By James Edwards, F.E.S. 8vo. Pp. 271, and ii. plates. London: L. Reeve & Co., 1896. Price 12s.

THIS forms a welcome addition to the series of Entomological volumes in course of publication by Messrs. Reeve. Mr. Edwards is the recognised authority on the Homoptera in this country, so that all that comes from his pen on this subject is of value. The plates of details are clear, and will be of great use. There is said to be a large-paper edition with twenty-eight coloured plates, sold at forty-three shillings, but of these plates we cannot speak, as we have only the small edition before us.

Seriously to criticise a specialist's writings on a very difficult group of insects like the present would be beyond our powers, so we will only notice a few points which appear to us not quite up to the standard of the rest of the book. In the introductory remarks on anatomy, the elytra and wings are treated too much as if they had nothing in common, in fact, a beginner might be led to imagine that a Homopteron had only two wings. This is especially unfortunate in a group where both pairs of wings are sometimes of almost similar texture, as in *Cicadetta*, and where the term elytra applied to the front wings almost contradicts the name of the sub-order—"Homoptera." We also think that, when considering the wings in their outstretched position, it is misleading to call the apical margin (*i.e.*, that furthest from the body) "the hind margin."

In the body of the work we prefer the plan adopted under *Liburnia pellucida*, where the description of the macropterous form precedes that of the brachypterous, and we think that the tables of species would have been clearer had the specific names been thrown into the margin.

We may also, perhaps, be allowed to wonder at the numerous species still retained, whose claim to a place in our list rests on a single specimen, often without locality, and to hope that our author may soon be able to clear some of these up, or, if not, to clear them

out. Unknown as many of them are on the Continent, there is great ground for suspicion that they are not valid.

The descriptive part of the work appears excellent, and the hints on collecting will be most useful. The scanty records of localities are deplored as much by the author as they can be by any one. We only hope the book will prove a stimulus to collectors and students generally.

DEEP-SEA AND PELAGIC FISHES.

OCEANIC ICHTHYOLOGY: a Treatise on the Deep-sea and Pelagic Fishes of the World, based chiefly upon the Collections made by the Steamers *Blake*, *Albatross*, and *Fish Hawk* in the Northwestern Atlantic. By George Brown Goode and Tarleton H. Bean. 4to. Pp. xxxv., 553, with Atlas containing 417 figures. Washington: Smithsonian Institution (United States National Museum Special Bulletin), dated 1895, received direct through the Smithsonian Exchange, January, 1897.

THE United States National Museum has done a great service to ichthyology in publishing these two handsome volumes (text and atlas) on the fishes of the deep sea and the extra-littoral parts of the ocean. The work is an attempt, by two of the most distinguished American ichthyologists, to summarise all that is known concerning these fishes, incorporating the results of their own researches with those of their predecessors, and making the whole a useful handbook not merely for specialists in the subject but also for biologists more immediately interested in other fields. It has, moreover, a melancholy interest as being the last great undertaking of the senior author, whose loss we have recently had to mourn (NAT. SCI., vol. ix., p. 339, Nov., 1896).

All oceanic fishes are included in this Treatise, partly because it is not yet possible to distinguish strictly between the two classes, and partly because the pelagic forms have often been mentioned in the discussions by previous writers on the deep-sea fishes. The strangest, however, are those from great depths, and it is in these that the chief interest of the work centres. The authors estimate that about 600 species have already been obtained from a depth of 1,000 feet or more. They also conclude that a very good general idea of the character of this fauna has already been acquired; for no startling novelties have appeared for several years, and the chief result of recent dredgings is the re-discovery of known types in new localities.

At the same time, there are many new genera and species to be found in most untried spots; and scarcely a beginning has been made in capturing the larger, swifter, and more cunning forms. The gigantic oar-fish (*Regalecus*), for example, a serpent-shaped, rapidly swimming creature, sometimes over twenty feet in length, has never yet been captured; although within the last century and a half dead specimens have been picked up on the shores of Norway, the Faroe Islands, Scotland, Ireland, England, France, the Mediterranean, Bermuda, the Cape of Good Hope, Hindustan, and New Zealand. Its world-wide distribution and the number of waifs give evidence that it is abundant in mid-ocean, yet the exploring ships in all the years of their combined searchings have found no vestiges of it, old or young. Where *Regalecus* lives, there may be others. Indeed, Drs. Goode and Bean think "it cannot be doubted that somewhere in the sea, at an unknown distance below the surface, there are living certain fish-like animals, unknown to science and of great size, which come occasionally to the surface and give a foundation to such stories as those of the sea serpent."

It is also to be remembered that about half of the deep-sea species are known only by single specimens, which, of course, cannot be sacrificed for dissection. Others are so delicate that their dilapidated remains, when brought to the surface, need great skill in interpretation.

The introduction, referring to matters such as we have just noted, extends only over five pages. The work itself begins as it ends with descriptive technicalities, lists of localities, and references to literature, without any attempt at generalisation or any anatomical notes even on the commonest forms. It is prefaced by a systematic index and a list of the new genera and species described by the authors; it concludes with a valuable alphabetical index of the whole.

The Chimæroids are regarded as a division of the Elasmobranchii, termed a sub-class on p. 5, an order on p. 30. No new facts of importance are recorded. The order Malacopterygii (of a class or sub-class not stated) follows, occupying no less than 94 pages, with family-divisions of a more restricted nature than those usually adopted. The arrangement of the Scopeloids is interesting, based upon the disposition of the luminous organs, a character already determined to be of systematic importance by Lütken. The authors, however, obscure their results by the unearthing of long-forgotten names and the (as it appears to us) useless adoption or invention of many new terms. The strange Sternoptychid fish *Chauliodus* is shown for the first time to possess an air-bladder. The order Lyopomi, established by Gill for the Halosauridæ, follows that of the Malacopterygii, and is itself succeeded by the great order of Apodes (eels), comprising some of the strangest forms of deep-sea fishes. A new species of *Pisodontophis* from the American coast is recorded as a boring parasitic fish, the dried and shrivelled remains of a closely similar animal being sometimes taken from the interior of salted halibut and codfish. The validity of the genus *Cyema* is doubted, and the authors think it may perhaps have been founded on a young *Nemichthys*, with its jaws and tail mutilated and partly repaired. The Heteromi follow with nothing new, and then are arranged the Berycoids, Scomberoids, Percoids, Scorpænoids, etc., under the order Teleocephali.

The work as a whole is so admirable and of such great utility, that it may seem ungracious to conclude our brief notice with severe criticism; more especially as the authors themselves beg indulgence for their shortcomings, on account of the difficulties and multifarious distractions amid which it was prepared. A treatise of this kind, however, if worth doing at all, is worth doing well; and a National Museum undertaking it ought at least to provide its officers with every facility to carry out their instructions in the best possible manner. As matters stand, it is obvious that the Government Printing Office deserves a large share of the blame. The preface and introduction are dated before midsummer 1895, and the title-page is marked with the same year; yet the publication was not issued until the end of 1896, and it did not reach Europe until early this year. If the dilatoriness of the Office is such after everything is completed, what must it be while the authors are reading the proofs? Their papers during the last few years, indeed, have often borne witness to their dissatisfaction; and it ought to be remarked that many of the fishes termed new genera and species in this work have previously been defined in the *Proceedings* of the same Museum. It is a serious omission in the present treatise, not to have pointed out this fact either in the Introduc-

tion or the Appendix. Again it is to be noted that the literary part of the work bears signs of having been entrusted to a third author not under proper control of the two responsible authors. To say nothing of the numerous "family diagnoses" based on ridiculously trivial characters, and the imposing "keys" filled with anatomical statements not verified in half the genera with which they deal—this collaboration has resulted in endless confusion and inconsistency. We are not now concerned with details, so will only cite one illustration of our meaning to caution the unwary reader. Take the case of the Order Malacopterygii, as it is termed. At the top of page 34, it is said to be characterized by "a mesocoracoid arch"; a few lines further down we are told that the large majority of the families comprised in this Order are destitute of the arch in question ("mesocoracoid wanting or atrophied"). As a matter of fact, the vast majority of the fishes placed here have never been examined in reference to the point. In the same table—which, like nearly all these higher "definitions," is marked "(*Gill*)"—the "Pterothrissidæ" are stated to have the "dorsal fin similar to and opposite anal," whereas on p. 50 Günther is correctly quoted in reference to this point thus:—"dorsal fin much elongate, many rayed; anal fin short." To make matters worse, Günther's figure of *Alepocephalus niger* is reproduced to serve for "*Pterothrissus gissu*," although the very same figure is copied under its correct name on a previous plate. Nor have the authors rectified this confusion in the copious Appendix. Finally, there is a total lack of decision as to what are "family" characters and what are "generic" characters, the same feature being continually mentioned in the higher definition and then repeated in the definitions subordinate to it. As to the lists of dredgings, they are printed in the most confusing manner possible, there being no attempt at tabulation for convenient reference. Even the list of deep-sea and pelagic fishes is carelessly compiled; and one whole genus of pelagic fishes *par excellence*, that of the flying-fishes (*Exocœtus*), is entirely omitted.

We have nothing to add concerning nomenclature and the changing of familiar names; those are questions of personal idiosyncrasy in most cases, and no code of Rules can control them. We would only repeat the expression of our gratitude to the authors for the great and useful task they have accomplished, and conclude with the hope that the U.S. National Museum will soon succeed in removing some of the disabilities under which its larger publications labour.

A Book for Billingsgate.

MARKETABLE MARINE FISHES OF THE BRITISH ISLES. By J. T. Cunningham. Pp. xvi., 375, illustrated. London: Macmillan, 1896. Price 7s. 6d.

THIS book, published under the auspices of the Marine Biological Association, may be succinctly described as a popular account of most of the scientific work done upon the life-histories of our food-fishes up to two or three years ago, supplemented by short sketches of the leading anatomical features of the common species of food-fishes, gleaned from Day and other reliable authors. As the blue-books and journals in which the former has appeared, and the voluminous works of the latter, are, to some extent, inaccessible to the amateur, this volume should prove a useful guide to the general subject, at least so far as it goes.

The book is divided into two parts, the first of which deals with the subject from general points of view, and the second consists of special remarks upon each common species.

In chapter I. the author undertakes to give a short *resumé* of the "History of Modern Investigations of the Subject," and here we do not think he is seen at his best: first, because the account is brought barely down to 1894, and considering the rapid progress of modern science, it is a grave defect for a book to be already over two years behind the times on the day of publication; secondly, because not only are there one or two misstatements of facts, but the whole *resumé* is calculated to give a layman a wrong impression with regard to the comparative magnitude and importance of the different observers' work therein referred to. To particularise, on p. 5 we are told that "Professor Allman . . . . . was the first to establish the fact that the spawn of the herring . . . . adheres to solid objects in the water." This was in 1862; yet more than half-a-century before, *i.e.* in 1803, Professor Walker gave an accurate account of the spawning of the herring, which had been also well known to fishermen years and years before. Later, in 1860, Dr. Boeck, acting under the Norwegian Government, produced an exhaustive work upon the spawning of this species, and also contested the suggestion that shoals of herrings performed vast annual migrations from the north. Mr. Cunningham is not the first scientific writer to ignore the early literature of the herring and its reproductive habits. Again, Professor McIntosh was appointed to "make observations" under the Royal Commission in 1883 and not in 1884 (p. 14), and from his Report it appears that the instructions of the Commission were carried out with an accuracy seldom excelled. One would hardly conclude this from the author's remarks upon it. Further on we note,—"Professor Huxley was unable to take any part in drawing up the Report, and therefore did not share in the responsibility for its conclusions and recommendations." (p. 15). In point of fact, the Report was subjected to his inspection, and he especially referred to the scientific part as a most valuable contribution.

On p. 8 is the following remarkable sentence:—"The investigation of problems relating to the fisheries is not of a kind to attract voluntary private effort. It does not promise great individual rewards in the shape of either fame or fortune, nor are the researches of that abstract philosophical kind, which, like virtue, are their own reward, and are therefore pursued for their own sake with no ulterior object." This may be the opinion of the author from his own standpoint; but to follow up such a dogmatic statement with references to the work of Professor McIntosh, Mr. Duncan Matthews, and a number of other naturalists, is, at the least, calculated to convey a wrong impression as to the motives underlying their labours.

With reference to the second point, we have no hesitation in saying that the investigations of the St. Andrews School (with the single exception of Mr. Holt, who, trained at St. Andrews, later became more intimately connected with the Marine Biological Association) have been either studiously ignored or merely referred to in a casual way. "Professor McIntosh and his pupils and assistants" (the order is quaint but perhaps euphonious) "describe as usual the results, etc." (p. 30), and three or four references of the same kind serve to indicate the work of the St. Andrews Laboratory, which afforded the greater proportion of the facts narrated in Part II. of the work before us.

Such misrepresentations are already bearing their fruit, as may be seen in the *Spectator* of December 19th, in which appeared an extraordinary article "On the practical study of fish." The anonymous author unblushingly ascribes to Mr. Cunningham the discovery that

the eggs of the majority of food-fishes are buoyant or pelagic: a discovery which, he remarks with unconscious humour, Mr. Cunningham was able to announce without the aid of a steam-launch.

Chapter II. gives a popular account of our "Valuable Marine Fishes," copiously illustrated by outline sketches of the species under consideration, which, with the exception of that of the angler, a very poor copy of Day's figure, help to convey a good idea of their general appearance. We were not up till now aware that the stickleback and the pipe-fish were "valuable food-fishes," and we were even under the impression that the lancelet was not usually regarded as a fish. The author is at some pains to explain to his readers that a lobster, an oyster, a star-fish, a jelly-fish, and a whale, are not true fishes: if his explanation is really necessary with our present standard of national education it is a very humbling thought. The account of the generation of fishes and their fecundity is a trifle voluminous, and, in parts, out of place in a popular work of this description.

The next two chapters deal with the eggs and larvæ, growth, migrations and habits. They are interesting reading and contain a useful collection of facts. The author is a little inclined to state *his* views upon disputed points as established facts, a habit which should be avoided by one who tells the "professional fishman" that "naturalists, although generally sick whilst at sea," are "on their guard against jumping at conclusions" (p. 4). "There can be no doubt that, in the sea, conger of both sexes die after spawning" (p. 84). This sentence, if read in one way, is with regard to the females a platitude, an impossibility in the case of the males, whilst if read in the other way, is a conclusion arrived at by a process closely akin to that of "jumping."

At the end of Part I. the author discusses the preservation of immature forms and the artificial propagation of fishes. He shows the inadequacy of the size-limits recommended by the Parliamentary Committee of 1893, and remarks: "As the circumstances of the trawling industry and the habits of the fish do not appear to admit of the preservation of all plaice, soles, turbot and brill.....till they have spawned once, we have to face the possibility of a continued diminution in the supply of these fish, in spite of all protection of the young, as a consequence of the excessive capture of the mature individuals." As a remedy for this lugubrious state of affairs, artificial propagation is discussed, and calculations entered into to show that "the total results of the work of the [Dunbar] hatchery is equivalent to leaving in the sea one mature female out of every 2,000 killed at Grimsby, a proceeding which would clearly not make much difference to the total supply of plaice in the North Sea" (p. 141). Although we believe the author's opinions to be erroneous, we can only point out here that the whole deduction depends upon the following:—"We may suppose that the destruction is nine times as great in the sea, which is certainly more than the actual proportion." A consideration of the whole physical environment of pelagic eggs and the enormous fecundity of the fishes spawning in this habitat points to a factor nearer ninety times nine than the author's estimate. His suggestion of keeping tame spawners in order to sow the sea with "vast quantities" of pelagic eggs can hardly be taken seriously.

With Part II., the "History of Particular Species," we must honestly say we are disappointed. Perhaps the "Monograph on the Sole," with its exquisite coloured illustrations, may have led us to expect too much; but with such a theme as our young fishes, one or two

skilfully-executed coloured plates might at least have been forthcoming. This is not all; for the figures provided for our perusal are in many cases anatomically inaccurate and poorly executed. It almost appears that the author has a special desire to depict his larval fishes, undergoing all sorts of contortions, illustrating much better the torsional and shrinking abilities of the larval anatomy than the beautiful symmetry of these little beings in their natural surroundings. The many figures borrowed from Holt, Prince, and Raffaele, are better, but scarcely benefit by their new environment.

The text shows evidence of great labour in the accumulation of facts, but there is a certain looseness of writing in evidence here and there. The author refers repeatedly to the anal fin as the 'ventral,' whilst the true ventrals or pelvics he sometimes designates 'pelvics,' at other times 'throat' or 'abdominal' fins. It would have been preferable, as he himself points out, to use the term 'pelvic' throughout, and thus to indicate an homology which might not of necessity be clear to the popular mind. The scientific term 'post-larval' is not referred to, though the post-larval stage is recognised as representing a well marked period of developmental history by other workers, from whose labours the author derives the majority of his facts. The attempt to avoid this term leads to an inextricable confusion between 'transition stage,' 'transformation stage,' 'young of,' 'later larval stage,' 'older stage of.....larva,' 'larva at a very late stage,' and so on.

The labour and energy that Mr. Cunningham has for years thrown into this department, and the excellent work he has done, must be freely acknowledged. But, for this very reason, the book before us cannot be placed to his credit. With an impartial statement of facts, a recognition of the work of others on the part of the author, and with a 'ha'porth of tar' from the publishers or the Marine Biological Association, in the shape of the employment of a trained artist and the consequent inclusion of a few coloured plates, a work of real value would have resulted.

A. T. MASTERMAN.

LABORATORY BOTANY.

DAS BOTANISCHE PRACTICUM: Anleitung zum Selbststudium der mikroskopischen Botanik, für Anfänger und Geübtere. Zugleich ein Handbuch der Mikroskopischen Technik. By Dr. Edward Strasburger. Third revised edition, with 221 woodcuts. Pp. 740. Jena: Gustav Fischer, 1897. Price 20 marks.

SINCE its first appearance in 1884 the Practical Botany ("das botanische Practicum") of Prof. Strasburger, has ranked as beyond question the leading book, in any language, on the study of the structure of plants. It was recognized at once as the work of a master, of one who has probably a greater experience in vegetable histology than any other living man, and who threw all his energies into the preparation of the book, so as to render the fruits of his experience available to others.

The first edition was an eminently readable book—a quality which one scarcely looks for in a laboratory guide. There was an agreeable freshness about it; all the illustrations were original, and everything in the book manifestly represented first-hand work. Apart altogether from its practical uses, the "Practicum" formed an interesting introduction to the histology of plants, for it covered a wide field, and contained much information not otherwise accessible. If the book, in its original form, had a fault, it lay, perhaps, in a certain want of system in its arrangement.

When a second edition was called for, within three years of the first, the author found it necessary to give his book a more severely practical character. The author then said in his Preface: "One thing has become perfectly clear to me; the centre of gravity of the book must lie in microscopic technology, and in guidance to scientific observation. This book could not be allowed to grow into a handbook of vegetable anatomy, but in microtechnical respects it had to reach such a degree of completeness that everybody could find in it what he wanted. I have therefore somewhat restricted the number of examples, while considerably increasing the technical instructions." Now that, after an interval of about ten years, a third edition has appeared, we find that further changes have been made in the same direction. "This time also" says the author (p. xii) "I have diminished the number of plants investigated, in order to give the necessary extension to that task in which the centre of gravity of the work lies, namely microscopic technology." In consequence of this, the book has no doubt become of even greater value to the practical investigator, but it has certainly lost something of its attractiveness for the general botanical reader, for nothing is so unreadable as long descriptions of methods and apparatus. However, a laboratory guide is nothing if not practical, and we have no right to complain if Prof. Strasburger's work, like some highly specialized organism, has become more and more rigidly adapted to the conditions of its existence. The book has grown, since the last edition, from 685 to 739 pages, but the increase is entirely in the technological Introduction and in the indices; the actual descriptive text has somewhat diminished.

The great feature of the Introduction is the prominence now given to the microtome and methods connected with its use. Since the second edition appeared, the microtome, as the author says (p. xi) has made its way into every institution which keeps up with the progress of the microscopic art. "The knowledge how to use it, must now be acquired by every body who wishes to work with success in the province of histology" (p. 31). English botanists have taken at least their full share in this important change, which in many cases has raised section-cutting from the region of chance into that of certainty. A number of forms of microtome are described and illustrated—among them our old friend the "Cambridge rocker," an imitation of which is now, it appears, "made in Germany." The part of the Introduction relating to the microscope and other optical apparatus has also undergone a thorough revision, in accordance with the present position of microscopy.

The arrangement of the contents of the 32 chapters on "Pensa" which form the main part of the text, has been somewhat modified, especially in the anatomical part, so as to give the whole course a more logical order. The headings of the chapters have been extended, in order that they may afford a complete idea of the contents of each, and of the material required. The large-print paragraphs contain all that is needed by the ordinary student, while a botanist who has worked through the whole, will be qualified for any histological investigation.

The author has evidently spent a vast amount of labour on this edition, for the latest results of research have been everywhere introduced, and usually tested by the personal observations of the writer. For example, the development of the starch-grains is now described in *Pellionia Daveauana*; the enzyme-sacs of Cruciferæ are explained in accordance with Guignard's researches; *Protosiphon* is separated from *Botrydium*, as the result of quite recent work by Klebs,

and the sexuality of the ascomycetous fungi is now definitely asserted, chiefly on the basis of Harper's observations.

The number of figures has grown from 193 to 221; the increase, however, is due to new illustrations of apparatus. In the descriptive chapters a certain number of old figures have disappeared, and some fresh ones have taken their place. Some of the omissions, both as regards descriptions and illustrations, will certainly be regretted by a reader who is familiar with the earlier editions. The roots of vascular cryptogams, for example, now come off very badly, with 5½ lines of text, and no figures. (p. 254). In the chapter on algæ the excisions are still more lamentable, for *Batrachospermum* and *Fucus* are now left out altogether; we cannot but regard these omissions as a change for the worse. The best figures illustrating the reproductive processes in the fir have also been sacrificed. On the other hand, we find a few welcome additions to the illustrations, especially among those relating to the anatomy of the Scotch fir and the lime-tree. On the whole, however, we fear that the loss, in the matter of illustrations, outweighs the gain.

The ideas of Van Tieghem (*see* NATURAL SCIENCE, vol. ix., p. 147) have had their due influence on the anatomical part of the book, though the term "stele," is not introduced until the Pteridophyta are reached (p. 247). The homology between the central cylinder of the stem, and that of the root is rightly emphasised, and justice is done to the French anatomist to whom we owe this fertile conception (p. 320). In one point, however, we have noticed that the stelar theory is not consistently applied. On p. 289 the central cylinder in the stem of *Hippuris* is still described as a "cauline vascular bundle," whereas it is manifestly not a single bundle at all, but an entire stele.

Many readers will turn at once to the concluding chapter, in order to learn the author's present views on the questions in dispute as to the nucleus and its division. Their curiosity will be rewarded, for on two of the burning histological questions of the day the author takes up a somewhat unexpected position. As regards the existence of centrosomes in plants he has very decided views, saying, in so many words, that "As the investigations on the botanical side now show, individualised centrosomes are peculiar, in the Vegetable Kingdom, to the Thallophyta and Bryophyta; they are absent from Pteridophyta and Phanerogams" (p. 611). Considering how recently almost all histologists (including the author) accepted Guignard's observations on the lily as affording the classical examples of centrosomes in plants, this strong negative expression of opinion is somewhat surprising. It must be alllowed, however, that the remarkable absence, so far, of confirmatory evidence, goes far to justify it. Prof. J. Bretland Farmer's discoveries of centrosomes in the Hepaticæ now occupy a prominent place in this chapter.

On the question of a reduction-division in the maturation of the sexual cells, Prof. Strasburger, whose openness of mind is proverbial among botanists, completely changes his position. He now asserts positively that in the second nuclear division of the pollen-mother-cells, the chromosomes are divided transversely and not longitudinally, so that here a true reduction-division, in Weismann's sense, takes place. This statement is in direct contradiction to the results of the most recent and careful work on the subject, notably that of Miss E. Sargant, and we cannot but regret the introduction of a dogmatic pronouncement, on so doubtful a point, into a book designed for students.

If we have found certain features of the book open to criticism,

it is none the less true that Prof. Strasburger's work remains at the head of all guides to the study of laboratory botany. No pains have been spared to render the "Practicum" more useful than ever to the practical worker. It may have lost something in freshness and in general botanical interest, but in completeness and elaboration of detail, it stands unrivalled as a guide to histological method.

D. H. S.

A NEW EDITION OF BRUSH'S MINERALOGY.

MANUAL OF DETERMINATIVE MINERALOGY. With an Introduction on Blowpipe Analysis. By George J. Brush. Revised and enlarged by Samuel L. Penfield. Fourteenth Edition. 8vo. pp. ix.,+164+63 to 96 in double-page tables+101 to 108 of Index, with 50 figs. London and New York: Chapman and Hall. 1896. Price 15s.

THE appearance of a new revised and enlarged edition of this well-known text-book is an event worth recording. As the result of Professor Penfield's work, the book, although retaining the general plan of previous editions, has been practically re-written, and at the same time almost doubled in size by the addition of new matter and illustrations. The additional matter includes an introductory chapter giving a summary of important chemical principles. These are enunciated very clearly but, we fear, too briefly to be of much service to the student (for whom they are presumably intended) who has had no previous knowledge of chemistry.

The chapters on apparatus and re-agents have been considerably extended, but follow on the whole the lines of the last edition. It is in the chapter on the reactions of the elements that the greatest departure from previous editions will be noted. From barely 14 pages this chapter has now been extended to 94. The elements, in alphabetical order, are treated under the headings, Occurrence and Detection. The enumeration of the principal minerals in which each element occurs is a new and useful feature. Where blowpipe tests are not decisive, full details are given of tests in the wet way: *e.g.*, in the case of the rare earths, the general methods of separation by means of oxalic acid, sodium thiosulphate and potassium sulphate are described. In this connection, however, we note at the bottom of page 65 a sentence which is so worded as possibly to lead the unwary student to the erroneous conclusion that Thorium may be separated from Zirconium by a double precipitation with sodium thiosulphate.

The descriptions of tests with known minerals which are given in smaller type under most of the elements are very suggestive and instructive. Throughout the book particular care has been taken to point out to the student the precautions necessary to insure success in any test; thus he is warned that in the case of fused material a blue colour with cobalt nitrate is not necessarily an indication of the presence of alumina, and that in testing for carbonates concentrated acids must not be used nor ebullition mistaken for effervescence. We are glad to note the subsidiary position assigned by the author to those stumbling-blocks, the cobalt nitrate test for magnesia and the microcosmic bead test for silica. That the book is well up to date may be judged by the fact that at least half a dozen lines are devoted to the consideration of Helium.

As stated in the preface, the book, as it is now presented, is only the beginning of a revision, for the tables for the determination of minerals have been left as in the last edition by Professor Brush. A complete revision of these tables, however, is to be made as soon as possible, and a chapter added on crystallography and the physical properties of minerals.

G. T. P.

A New Science.

Gemmographical Tables for the use of Diamond and Gem Merchants, Jewellers and Students, exhibiting in tabulated form, the distinguishing characteristics of rough and cut stones. By W. J. Lewis Abbott, F.G.S., London: Heywood and Co. Price 1s. 6d.

We are inclined to welcome with approval any effort to introduce scientific methods to the notice of jewellers and merchants of precious stones, to whom they are certainly not too familiar, and Mr. Lewis Abbott's tables aim at this desirable result.

The main features of the various gem-stones are arranged in five tables dealing respectively with their names and colours, their composition and physical properties, their crystalline form, and the colours which they present in the dichroscope. It is to be hoped that these tables will find a use among those for whom they are intended, and will lead them to recognise the practical value of a subject which is taught by the author at the Polytechnic Institute, and apparently with considerable success, though under the unfortunately hybrid name of gemmology.

The reader must be warned that garnet does not crystallise in pentagonal dodecahedra, nor spinel in tetrahedra; neither must he suppose that all the stones included in the formidable list of table 1 are usually recognised as gem-stones.

But these are minor blemishes and we may safely commend these tables to the attention of jewellers, feeling sure that they will derive benefit from some slight insight into scientific ways of testing precious stones.

Histology of the Stomach.

Lehrbuch der Vergleichenden Mikroskopischen Anatomie der Wirbeltiere. I. Der Magen. By Dr. Med. Albert Oppel. 8vo. Pp. viii., 543, with 5 plates and many text-figures. Jena: Fischer, 1896. Price 14 Marks.

It is now forty years since Franz Leydig published his text-book, and since then there has been no serious attempt to bring together in a systematic fashion our accumulated knowledge of comparative microscopic anatomy. The delay was natural, and perhaps not to be regretted. The forty years have seen the whole science of anatomy informed by a new principle, and evolution had its youthful wild oats to sow. Vertebrate anatomy, and certainly the details of vertebrate histology, save so far as they bore directly on physiology, were deserted by many acute minds for the new world of promise opened out by comparative embryology and the investigation of the widely diverse invertebrate groups. It seemed an old-fashioned trifling to discuss the minute structural differences to be found in vertebrate mucous coats, when the ancestry of the whole vertebrate group was to be expected from serial sections through a pelagic worm. Probably the best and the worst of this attractive method of investigation are now known, and anatomists are turning again to the closest comparisons between the minutest details of nearly allied forms. And these 500 pages on the histology of the vertebrate stomach are a sign of the new direction of anatomical activity. A great bulk of the literature cited is not more than ten years old, and it is plain that the book will have its greatest value as a stimulus to still more detailed investigation.

The author begins by a general account of the conformation of the region between the end of the œsophagus and the beginning of the duodenum. He describes the kaleidoscopic varieties of external form into which the region is thrown, and discusses generally the

minute structure of the epithelial, muscular and glandular layers of which it it composed. The greater part of the volume is occupied by a systematic account of the various groups. The classification employed is broadly popular, including for instance *Amphioxus* and the cyclostomes among fishes, but it serves well enough as a guide to the contents of the volume. We have spied minutely into the author's use and knowledge of the literature of the subject in various branches, and we have never found him wanting. A large number of figures, reproduced or original, are given; the index, references, and bibliography seem admirable, and we have nothing but the highest praise for the accomplishment of a laborious and useful task.

A CATALOGUE OF MAMMALS.

CATALOGUS MAMMALIUM, TAM VIVENTIUM QUAM FOSSILIUM, a Dr. E. L. Trouessart. Nova editio (primus completa). Fasciculus I.—Primates, Prosimiæ, Chiroptera, Insectivora. Pp. 218. Berlin: R. Friedländer und Sohn, 1897. Price 10 marks.

FEW works of so unpretending a character have been of greater service to working mammalogists than the "Catalogue des Mammifères vivants et fossiles" published by Dr. Trouessart in 1879–86, and as it is now both out of date and almost unobtainable, the present revised edition of it will certainly receive a cordial welcome. The original edition was never completed, mainly, we believe, on account of the difficulty of finding a publisher, and it speaks little for French enterprise that the learned author of this list has now had to send it to Berlin to be published.

As may be gathered from the title of this fascicule, the author considers the Lemurs to be worthy of full ordinal rank. While many naturalists would have agreed with him on this point a short time ago, Dr. Major's discovery of *Nesopithecus* (*see* NATURAL SCIENCE, vol. x., p. 83) would perhaps make them pause, as its evident relationship both to monkeys and lemurs would seem to reduce the width of the gap between them.

The new edition is got up by Messrs. Friedländer in a style far superior to the previous one, is better printed, and, considering the thousands of names and references that crowd its pages, there seem to be remarkably few misprints. Indeed, in the 218 closely printed pages of which the part consists, we have only noticed some three or four ordinary misprints, although there are a score or more due to the practice of giving capital letters to specific names derived from persons. This plan, besides its other demerits, seems, owing to its destroying the uniformity of the printing, to offer exceptional facilities for such errors. Thus we notice *Scapulatus*, *Centurio*, *Samoensis*, *Satyrus*, *Gorilla*, *Nictitans*, and *sancti-johannis*, all printed in a manner contrary to the author's general rule in such cases.

The geographical distribution of each species has been carefully recorded; but it would have been a boon to workers, if the typical locality for each synonym had been printed separately opposite the name, instead of being lumped up with a "ditto" under the general range for the whole. For knowledge of the type-locality for every synonym of any species under review is a prime necessity to the worker, and the form of Dr. Trouessart's list is such that this information could have been, and we hope in future fasciculi may be, easily inserted without increase of space or labour.

Being avowedly a compilation, the subject-matter is scarcely open to criticism, and we can only congratulate Dr. Trouessart on the full

and admirably selected number of references he has given and on the way in which he has been able to bring them absolutely up to date. We notice, however, that in the part on the Bats, no reference to Blanford's "Mammals of India" is given, while in that on the Primates the work is referred to continually, but as 1891 instead of 1888, the latter date being correctly quoted in the Prosimiæ and Insectivora.

We do not quite understand on what grounds Dr. Trouessart rejects all the names recently given by Mr. Lydekker to genera of bats and returns to the pre-occupied names used by Dobson, and similarly adopts *Brachyurus* for the Ouakari monkeys. If he does not admit that pre-occupation invalidates a name, he ought surely to use the widely-known *Troglodytes* for the Chimpanzee, instead of the technically correct *Anthropopithecus*. He has also often rightly re-named pre-occupied names himself.

These slight blemishes apart, Dr. Trouessart has given us a work which will have to be in the library of every mammalogist, and, when there, will probably be of more use than the great majority of more pretentious works. O.T.

A Guide to Geological Literature.

Catalogue des Bibliographies Geologiques. Par E. de Margerie. Pp. xx., 733. Paris: Gauthier-Villars, 1896.

This most useful work is produced under the auspices of the International Geological Congress, which in 1891 and again in 1894 appointed a Committee for the purpose. Though help has been received from the members of this Committee, every item has been checked and the whole arranged by Mr. de Margerie himself. There are nowadays so many bibliographies or bibliographic lists published for the guidance of the student, that they themselves require a bibliography. A geologist wishing to consult the literature of any subject will therefore begin with the present work, which will tell him, not what books have actually been written about the subject, but what books contain lists of the literature pertaining to the subject; to such books he will next turn, and so be guided ultimately to the literature itself.

The work is divided into a "Partie Générale" and a "Partie Régionale." The former contains histories and bibliographies of general geology, periodical bibligraphies, personal bibliographies (*i.e.*, author-catalogues), subject-bibliographies, and geographical geology including map-lists. The regional part is divided according to countries, and each of these is subdivided in much the same way as the general part, but contains in addition lists of Survey publications and library-catalogues. In both sections the term bibliography has received a wide interpretation; thus, the list includes H. S. Williams: "The scope of paleontology" which is really historical, as well as many items that have little more than a biographical interest. Bibliographies still in MS. are also entered: thus, we find C. D. Sherborn's "Index Animalium." There are three indices: of authors, subjects, and countries.

In a work so embracing, perhaps too much so, one could hardly fail to note many omissions, some of them serious. It seems, however, more profitable to send additions and corrections to Mr. de Margerie, at 132 rue de Grenelle, Paris, and we hope that other users of the work will follow our example. Copies of the work are presented to geologists who attended the congresses at Washington and Zurich, while others may purchase it for (we believe) £1.

BIBLIOGRAPHIES.

UNDER the direction of the late G. Brown Goode, the Smithsonian Institution has produced, as *Bulletin* No. 49 of the U.S. National Museum, a "Bibliography of the published writings of Philip Lutley Sclater" (Washington, 1896, xx. and 135 pages). It is divided into: Introduction; Biographical Sketch; Part I., Chronological Catalogue of Separate Works (26 items); Part II., Chronological Catalogue of Papers (items 27–1239); Part III., List of new genera and families described; Part IV., List of new species described; Part V., List of species figured; Part VI., Index to subjects in Parts I. and II.; Appendix, List of Works, "published subsequent to December, 1894," down to the description of Count von Götzen's journey across Africa, contributed by Mr. Sclater to our last July number (items 1240–1287). It is only fair to say that of these 1287 items nearly half are Exhibitions, or Reports, or Abstracts of matters received by the Secretary of the Zoological Society, and brought by him before the Fellows at their evening meetings in the ordinary course of his duties. The rest form a remarkable contribution to knowledge from a man who has every prospect of a much longer career of activity. The typography and arrangement of the lists is compact and clear; but more emphasis might have been laid on dates. Clearly the items are not in strict chronological order, and we should not be at all surprised to learn that No. 1182, for instance, quoted as *Proc. Zool. Soc. London*, 1893, was really published in 1894. The work of copying and arranging the titles was performed by Mr. G. A. Doubleday.

The Geological Commission of the Colony of the Cape of Good Hope has issued, as its first publication, a "Bibliography of South African Geology," compiled by H. P. Saunders, Secretary to the Commission. It forms an octavo paper-covered pamphlet of 56 pages, and records 592 items. It is proposed to issue supplements with the Annual Reports of the Committee. This publication should prove most valuable to the numerous people now interested in the Geology of South Africa.

WILLESDEN.

ONE does not usually expect to find in such a publication as the *Willesden Year-Book and Ratepayers' Guide*, 1897, sold at the humble price of 3d., any article of interest to our readers. We are the more pleased to see herein some interesting remarks by Mr. W. North on the River Brent. Among other things, he draws a comparison between the Brent as it was and as it is, greatly to the disadvantage of the present conditions. "The once clean and vigorous life of the stream is gone, and its place is taken by lowly forms that do their duty manfully, if one may use the term, yet vainly, trying to cope with the excess of food supplied to them by Philip's successors." Philip was a farmer, but his land is now given over to stray donkeys and gypsies. It certainly seems conducive neither to health, morals, nor the higher education of the people, that a stream which once served as background for the idyllic scenes of Lytton's "My Novel" should have been turned by the local authorities into nothing more than a stinking sewer. The Year-Book also contains a charming little article by Dr. F. A. Walker on the natural history of what was once "Price's Field," but is now obliterated by suburban villas of the usual type. There are also notes on the geology of the neighbourhood of Willesden, useful from containing particulars of a well sunk to a depth of 464 feet by Messrs. Welford & Sons, at their dairy in Elgin Avenue.

Scraps from Serials.

We have received *Bulletin* No. 6 (n.s.) of the Entomological Division of the U.S. Department of Agriculture, which contains the Proceedings of the Eighth Annual Meeting of the Association of Economic Entomologists, held at Buffalo in August, 1896. The address of the President, Mr. C. H. Fernald, deals with the Evolution of Economic Entomology, giving a brief history of insect ravages from the plagues of Egypt to the present day. There are a number of other papers bearing on the special work of the Association. Of general interest is an account by Mr. F. M. Webster of the areas in Ohio affected by the Chinch Bug in three successive years (1894-6). Although the successive appearance of the insects in different tracts of the state could be in part explained by meteorological conditions, several anomalous facts still await elucidation.

Timehri (vol. x., pt. 2, Dec., 1896) is full of interesting matters, chief among which is Mr. Quelch's "Migratory Birds in British Guiana." Some notes of fly-fishing in the colony are given by "Oxon," and from his account one sees that far more than ordinary patience is required, as the sand-flies and mosquitos are unwearying in their attacks, and before 8 a.m., the fierce horizontal rays of the sun burn back, arms, and hands, so that they become swollen and scarlet, while, reflected from the water, they take the skin off the nose. H. B. Van Ree writes practically on the culture and manufacture of Tobacco, while history has its exponent in the Hon. N. Darnall Davis, who gives an account of the Early English Colonies in Trinidad.

La Naturaleza, vol. ii., nos. 10 and 11, reach us from Mexico, both published in 1896. Herpetology is represented by the description of new species of *Geophis* and *Amblystoma* by Dr. Dugès, who also gives a note on the intestine of *Crocodilus americanus*, and a list of the Reptilia and Batrachia of the Mexican States; and by Dr. M. G. Peracca, who writes on the reproduction of *Iguana tuberculata*. Botany includes pp. 185–263 of Mociño y Sesse's Flora Mexicana, with index A–H; *Casimiroa pubescens* by Dr. Manuel M. Villada; and *Tabebuia donnell-smithii* by J. N. Rose. Juan Ignacio de Armas writes on the Zoology of Colon; Mexican Anthropology is dealt with by Herrera and Cicero; and Dr. José Ramirez' discourse to the eleventh Congress of Americanists, on the autochthony of the primitive races of America, is also printed. Dugès also describes a new moth *Ophideres raphael*.

We have received vol. III, no. I, of *Records of the Australian Museum*, edited by the curator, R. Etheridge, Jr., who contributes to it articles on the circular and spiral incised ornament on Australian aboriginal implements and weapons, including a spear from Angeldool, N.S.W.; on an *Actinoceras* from N.W. Australia, a genus of cephalopod not hitherto recorded from the Carboniferous rocks of that country; on the discovery of bones, chiefly of *Diprotodon*, in granitic detritus at Cunningham's Creek, near Hawarden, N.S.W. The late F. A. A. Skuse announces that *Peripatus leuckharti* has been discovered 72 miles S. of Sydney and near the Jenolan Caves, Blue Mts., N.S.W., and at a height of 2000 feet at Cunningham's Gap, South Queensland. The specimens stated by F. J. Bell and A. Sedgwick to come from Wide Bay, Queensland, were, says Mr. Skuse, really collected by himself in Brisbane. C. Hedley describes a North Papuan land-shell under the name *Thersites septentrionalis*. A. J. North, after having delivered himself of a new sub-species of *Psophodes crepitans*, gives some interesting ornithological notes. We note that Mr. Hedley gives his measurements in the metric system; cannot the editor follow his

example, and induce Mr. North to do the same, or at all events not to give us measurements in decimals of an inch?

NEW SERIALS.

THE *Natural Science Journal* is published monthly by the Atlantic Scientific Bureau, New Bedford, Mass., at 1 dollar per annum. There is a staff of six editors. No. 1, which has been sent to us, consists of 28 pages, including advertisements. There are short articles, platitudes, and poems, none of which are vulgar; and the following conundrum is offered to readers of the *Journal*: "What is an xld specimen?"[1] The *Journal* appears to be the organ of a company of dealers in natural history specimens. Despite the similarity of title, we do not think that it is likely to be confused with NATURAL SCIENCE.

We have received the second number (February 1897) of the *Scottish Medical and Surgical Journal*, an octavo monthly of 96 pages, edited by Dr. William Russell, under the direction of eleven leading Scottish medical men. It is published by W. F. Clay of Edinburgh, at a price of two shillings: annual subscription one guinea. The present part contains several good original articles of medical and surgical interest, with reports of meetings of societies, and abstracts of current literature.

The resuscitated Aeronautical Society, alluded to in our last number, has issued the first number of the *Aeronautical Journal*.

We also learn that Messrs. Marshall, Russell and Co., London, and Messrs. Hughes and Harber, Longton, Staffordshire, are to publish a quarterly, dealing, as its name implies, with *East Asia*. The editor is Mr. H. Faulds, of Fenton, Stoke-on-Trent. Papers dealing with natural history will be included, as well as an index to magazine and newspaper articles touching on Eastern Asia.

FURTHER LITERATURE RECEIVED.

Relics of Primeval Life, J. W. Dawson: Hodder & Stoughton. First Principles of Natural Philosophy, A. E. Dolbear: Ginn, Boston, U.S. Manuel de Geographie Botanique, Drude Poirault livr. 14–16: Klincksieck. The Ancient Volcanoes of Great Britain, A. Geikie: Macmillan.

The Danger to American Horticulture from the Introduction of Injurious Insects, T. D. A. Cockerell. The Comparative Physiology of the Suprarenal Capsules, S. Vincent: *Roy. Soc.* (proof). Rep. Proc. Soc. Nat. Hist. Cheltenham College, 1896. A National Department of Science necessary for the Co-ordination of the Scientific Work of the U.S. Government, C. W. Dabney, Jr.: *Science*. Civil Service in the Department of Agriculture, C. W. Dabney, Jr.: *U.S. Dep. Agric. Circ.* The National University, A Growth, not a Creation, C. W. Dabney, Jr.: *Science*. Nansen the Norseman, A. Crane: *Brighton Herald*. Descrip. of two new Murine Opossums. Phenacomys preblei, a new Vole from the Mountains of Colorado. Revision of the Coyotes or Prairie Wolves, etc., C. Hart Merriam: *Proc. Biol. Soc. Washington*. Some Spinning Activities of Protoplasm in Starfish and Echinus Eggs, G. F. Andrews: *Journ. Morphol.*, Abstr.: *Amer. Nat.* Bibliogr. of S. African Geol., Geol. Com. Cape of Good Hope. Mem. Austral. Museum, iii. The Ganodonta and their Relationship to the Edentata, J. L. Wortman: *Bull. Amer. Mus. Nat. Hist.* Guide to the Fossil Invertebr. and Plants, Dept. Geol. and Palæont., Brit. Mus. Nat. Hist. Rep. Colombo Mus., 1896, pt. iv.

Scot. Geogr. Mag., April; Amer. Journ. Sci., April; Victorian Nat., Feb.; Botan. Gazette, March; Chivers' New Book List, April; Feuille des jeunes Nat., April; Halifax Natural., ii., No. 7; Illinois Wes. Mag., March; Irish Nat., April; Westminster Rev., April; Journ. Mar. Biol. Assoc., iv., No. 4; Yorksh. W. Post, April 10; Journ. School. Geogr., March; Knowledge, April; Literary Digest, March 13, 20, 27, April 3; McClure's Mag., April; Naturæ Novit., March; Naturaleza (Madrid), viii., Nos. 9 and 10; Naturalist, April; Nature, March 25, April 1, 8; Nature Notes, April; Naturen, March; Photogram, April; Revue Scient., March 27, April 3, 10; Science, March 12, 19, 26, April 2; Science Gossip, April; Scientific Amer., March 13, 20, 27, April 3; Proc. Biol. Soc. Washington, vol. xi.; Journ. Coll. Sci. Imp. Univ. Japan, vol. ix. (2).

[1] We are given to understand that xld is dealers' jargon for "crystallised."

OBITUARY.

EDWARD DRINKER COPE.

BORN JULY 28, 1840. DIED APRIL 12, 1897.

AMERICA has lost one of its most eminent biologists in the person of Professor Cope, of Philadelphia. For some time the friends most intimately associated with him had noted with concern a rapid failing in his health and sad aberrations in his once great intellect. Born in Philadelphia, where he spent the greater part of his life, Cope received his earliest scientific training in the University of Pennsylvania. He completed his studies in Europe, and obtained the degree of Ph.D. at Heidelberg in 1864. In the same year he was appointed Professor of Natural Science in Haverford College in his native city. He resigned this position three years later, partly from ill-health, and between the years 1871 and 1873 took part in many geological exploring expeditions in Kansas, Wyoming, and Colorado. From 1873 to 1878 he was engaged in field-work with the Wheeler Survey, established by the United States Government. He was also Vertebrate Palæontologist to the Hayden Survey. At this time his private fortune was ample, and he was able to pursue his general biological and palæontological researches quite independently of State appropriations; but during the next decade misfortune overtook his investments, and in 1889 he gladly accepted from the Pennsylvanian University the Professorship of Geology and Mineralogy, which he held until two years ago, when he was transferred to the Professorship of Zoology and Comparative Anatomy. In 1895 he became President of the American Association for the Advancement of Science.

Cope's first paper, on the primary divisions of the Salamandridæ, was published in the *Proceedings of the Philadelphia Academy* so long ago as 1859, and subsequently to that date he made about 400 contributions to various scientific serials, in addition to his numerous important official publications issued by the United States Government. He not only treated of the facts of zoology, derived both from living and extinct groups, arriving at many fundamentally new and important results in classification; but since 1869 he also wrote much on the philosophy of the subject, particularly the problems of evolution. His latest book, "The Primary Factors of Organic Evolution," summarising much of his work, was reviewed in our January number. Cope, however, has left so enduring a mark on the progress of zoology that no brief obituary can do adequate justice to his genius. We propose to publish a more extensive appreciation of his work, by Mr. A. S. Woodward, next month.

THERE are also announced the deaths of:—Dr. KENNGOTT, Professor of Mineralogy in Zurich University, and author of "Handwörterbuch der Mineralogie," at Lugano; L. N. JOHNSON, formerly botanical instructor at Michigan University, on February 27, at Boulder, Colorado, aged 34; on February 23, in Paris, GEORGES VILLE, Professor of Plant-physiology at the Musée d'Histoire Naturelle, aged 73; JAROSLAV KOŠTÁL, assistant in zoology at the Technical High School, Prague; on March 14, aged 79, Dr. ROBERT HOGG, author of the "Fruit Manual," and formerly editor of the *Cottage Gardener*, subsequently the *Journal of Horticulture*.

NEWS OF UNIVERSITIES, MUSEUMS, AND SOCIETIES.

THE following appointments are announced :—

Dr. R. von Lendenfeld, to be Professor of Zoology at Prague; A. W. Hughes, to be Professor of Anatomy at King's College, London, his place as Professor of Anatomy at the University College of S. Wales and Monmouthshire being taken by Dr. A. F. Dixon of Dublin University; Dr. Ernst Gaupp, of Breslau, to be Professor Extraordinarius of Embryology at Freiburg.

G. F. Scott-Elliot, to be Lecturer in Botany at the Glasgow and West of Scotland Technical College; Dr. H. Ross, to be Curator of the Botanical Garden at Munich; Dr. W. I. Palladin, of Charkow, to be Professor of Botany at Warsaw; Dr. P. Cannarella, to be Assistant in the Botanical Garden at Catania; Dr. Luigi Buscalioni, of Turin, to be Assistant in the Botanical Institute of Rome University.

Dr. Carl Burckhardt, of Basle, and Dr. Leo Wehrli, of Zurich, to be Geologists at the Museum of La Plata.

Dr. Erich Wernicke, to be Professor Extraordinarius of Hygiene at Marburg University; Dr. J. Petruschky, to be Director of the Bacteriological Institute, Dantzig; Dr. Jas. Clark to succeed J. Muir as Professor of Agriculture at the Yorkshire College, Leeds.

WE rejoice to learn that Sir William Flower, who has just reached the age-limit of the Civil Service, has been granted by the Treasury an extension for three years. The work accomplished last year under the immediate supervision of the Director of the British Museum (Natural History) is proof, if proof be needed, that Sir William has not yet grown stale in office. We wish him all health and strength to carry out his numerous plans.

MESSRS. GODMAN and Salvin have offered to the Hope Department of the Oxford University Museum a valuable collection of butterflies, especially rich in species from Central America, a district poorly represented in the Hope collection.

THE Museum of Economic Geology in New York University has received series of specimens illustrating the geology of various anthracite basins, and numerous important mines in the United States. The new museum of the University is now nearly finished.

THE Colombo Museum, Ceylon, from the 1896 Report of which we quote largely in our Notes and Comments, shows a very satisfactory state of advance so far as the scientific part of the work is concerned. Extension of the buildings, however, is greatly needed, and other expenditure seems desirable. Bats, for instance, have taken to entering the building through the open ironwork above the doors, and caused much unpleasantness and even damage.

THE Glasgow Museum has recently secured from the executors of the late David Corse Glen, under very favourable conditions, that geologist's well-known collection of over 8,000 mineral specimens, as well as many rock specimens, fossils, recent shells, and other natural and prehistoric objects. It has also purchased Alfred Brown's fine collection of British shells. Among the donations we notice a specimen of *Spirula lævis* from the South Pacific, but it is not stated whether the soft parts are preserved.

THE following are forthcoming lecture arrangements of the Royal Institution:—Dr. Tempest Anderson, four lectures on Volcanoes (the Tyndall lectures), April 27, May 4, 11, and 18, at 3 p.m.; Dr. Ernest H. Starling, three lectures on The Heart and its Work, May 25, June 1 and 8, at 3 p.m.; and Prof. Dewar, three lectures on Liquid Air as an Agent of Research, May 27, June 3 and 10, at 3 p.m. The Friday evening meetings will be resumed on April 30, when a discourse will be given at 9 p.m., by Prof. J. J. Thomson, on Cathode Rays; succeeding discourses will be given by Prof. Harold Dixon, May 14, Lord Kelvin, May 21, Prof. H. Moissan, May 28, Mr. W. H. Preece, June 4, Mr. W. Crookes, June 11, and other gentlemen.

THROUGH the instrumentality of Mr. Frank Finn, three specimens of the Indian pigmy goose (*Nettopus coromandelanus*) have been added to the Zoological Society's collection in Regent's Park. Although not by any means a rare species, this bird has never, says the *Daily Chronicle*, been exhibited previously in any zoological collection anywhere, all attempts to bring it alive to Europe during the past quarter of a century having failed ignominiously.

MR. H. M. VERNON, of Merton College, Oxford, and Rolleston prizeman, has been elected to the Radcliffe Travelling Fellowship of the University of Oxford.

THE Report of the Director of the Marine Biological Association states that between August and February last seven naturalists worked at the Plymouth Laboratory, which was also visited by four fishermen making a tour to the various fishing centres of England and Scotland, under the auspices of the Aberdeenshire County Council and the guidance of Mr. R. Turnbull, B.Sc. Trawling in the bays on the Devonshire coast showed that in January the larger plaice had left, probably for the spawning-grounds, whilst the fish from the estuaries and close inshore had come out into the bays. Experiments have been started for determining the surface drift in the western portion of the English Channel by means of soda-water bottles, which are to be put overboard by torpedo-boat destroyers cruising in the neighbourhood. The steam launch "The Busy Bee" has cost £700, towards which amount £537. 14s. has, so far, been subscribed. During the Easter Vacation, Mr. W. Garstang has again conducted the course in marine zoology started by him last year.

Similarly Prof. H. C. Bumpus has been taking seventy students of comparative anatomy for an excursion on Narragansett Bay.

THE South-Eastern Union of Scientific Societies will hold its second annual Congress at Tunbridge Wells on May 21, 22. The following papers are notified:—Rev. J. J. Scargill, "What can be done to save our Fauna and Flora from unnecessary destruction?"; S. Atwood and J. W. Tutt, "How can the Technical Education Grant assist local Scientific Societies?"; W. Cole, "Local Museums"; G. S. Boulger, "The Committee on Field Clubs"; H. G. Seeley, "Current Bedding in Clay"; H. E. Turner and W. Whitaker, "Search for Coal in S.E. England"; W. J. Lewis Abbott, "History of the Weald in special reference to the Age of the Plateau Deposit." At a conversazione, given by the Mayor, Dr. Rowe will demonstrate the method of preparing Chalk fossils described by him in NATURAL SCIENCE for November, 1896. Members of Natural History or Scientific Societies in the S.E. District affiliated to the Union are admitted on payment of half-a-crown; delegates of similar societies pay five shillings; others interested are admitted for three shillings and sixpence.

THE Literary and Philosophical Society of Sheffield intend to celebrate the semi-centenary of Dr. H. C. Sorby's scientific activity, by having his portrait painted. Subscriptions will be received by A. T. Watson, Assay Offices, Leopold Street, Sheffield.

THE programme of the Hull Scientific and Field Naturalists' Club for April, May, and June, shows a goodly list of excursions and papers. Since the club is

affiliated to the Yorkshire Naturalists' Union, its members can avail themselves of the circulars issued by the Union descriptive of the natural history of various districts visited. The Recorders of this Club take note of all important finds made by its members, and undertake the identification of doubtful specimens.

THE Belfast Naturalists' Field-Club has again arranged with Professor Grenville Cole for a course of instruction in practical geology. This Club does useful work in organising the scientific activities of its members. Its geological section has been investigating the erratic blocks of the neighbourhood on the lines of the International Boulder Committee of the British Association.

THE Limerick and Clare Field-Club has, we learn from the *Irish Naturalist*, added archæology to its field of work, with the immediate result of raising its list of members from 60 to nearly 200. We trust that the archæologists intend to do serious work, such as is now being done by so many of the Irish Field-Clubs, and that they are not merely on the look-out for picnic excursions.

FROM the *Report* of the Cheltenham College Natural History Society for 1896 we learn that the Old Chapel is about to be used as a Library and Art Museum, so that it will perhaps be possible to devote the present Museum room entirely to natural history, and so to arrange the objects more adequately. The Report contains some faunal and floral lists, giving dates of first flowering, of arrival of birds, and of egg-taking. Such observations are of real value in themselves, and of ever greater value in their educational effect.

Similar work used to be done by the Winchester College Natural History Society, which, however, if not actually extinct, has issued no *Report* for some sixteen years. Still the geologists, under the guidance of Mr. C. Griffith, have occasionally given evidence of fruitful activity. Possibly the new museum, which is to be opened on June 16, will afford opportunities for natural history work that have hitherto been lacking.

ON May 18, Mr. Andrée again leaves Gothenburg for Spitzbergen, in the gunboat "Svensksund," to resume his attempt to cross the polar ocean in a balloon. The balloon has been enlarged, so as to remain dilated for six weeks. Dr. Ekholm, however, considering that it is not strong enough, has retired from the expedition, and his place has been taken by Mr. Knut Fränkel, a civil engineer. It is expected that all will be ready for a start by June 20. A similar attempt is projected by the French aeronauts, Messrs. Godard and Surcouf, who intend to start next spring in a baloon with a capacity of over 35,000 cubic feet.

Science for March 26 announced that a tariff Bill then before Congress imposed an *ad valorem* duty of 45 per cent. on scientific apparatus "imported especially for colleges and other institutions," of 25 per cent. on books imported for public libraries, on books "printed in languages other than English," on books "printed more than twenty years," on books "devoted to original scientific research," and on works of art.

It is also announced that the State of Minnesota intends to appoint a State Phrenologist, who is to examine at least 2,000 heads *per annum*.

We do not know which of these two pieces of legislation is the more ridiculous or astounding; there is no question but that the former is the more dangerous, and we rejoice to learn from a later number of *Science* that some modifications are to be introduced into this extraordinary Bill.

Octopus giganteus, Verrill (*see* NATURAL SCIENCE, March, p. 207) turns out to be nothing more than a mass of blubber, probably from the head of some huge cetacean. The moral of this is that one should not attempt to describe specimens stranded on the coast of Florida, while sitting in one's study in Connecticut.

CORRESPONDENCE.

Time and Change in Foraminifera.

I cannot permit the observations made in the March number of Natural Science (p. 153 *ante*) respecting some criticisms I made in the *Revue critique de Paléontologie* on the recent work of Messrs. Rupert Jones, Burrows, Chapman and others on the Foraminifera of the Crag, to pass without making some reply thereto.

I am sorry not to have expressed myself "with the lucidity of my nation"; what I meant to say was that descriptions of fossils to a large extent fail when they do not recognise separate species as such. The palæontologist should seize upon every convenient opportunity to distinguish species where they characterise horizons or geographical provinces. In the present instance I may remark that when such a careful observer as Mr. Schlumberger definitely states that he can separate Eocene Foraminifera from those now living, and describes and figures the differentiating characters, palæontologists surely must accept his work or say in what way it is at fault. Mr. Schlumberger shows us that under the name of *Biloculina ringens*, which Lamarck proposed for an Eocene species from the Paris Basin, two living species have been confounded, to which he gives the names *Biloculina sarsii* and *B. bradyi*. In like manner the living *Biloculina bulloides*, d'Orbigny, must be distinguished from the fossil species and becomes *B. anomala*, Schl. and *B. lucernula*, Schl.; and many other examples could be quoted. Palæontology teaches us that throughout long periods of time animals usually undergo some change, so that before assigning a species to one belonging to a different stratigraphical horizon, or to another geographical province, it is necessary to study that species very carefully and to give it the benefit of any differentiating characters that may be found to exist. It is better to err in recognising these differences as of value in separating species, than to submerge them and thus invite worse confusion in the distinction of species. I am a little doubtful whether the learned authors of the "Crag Foraminifera" have not contributed to our difficulties in the manner last mentioned.

Gustave F. Dollfus,

Paris, *March* 18, 1897. *For. Corr. Geol. Soc.*

[We are in full accord with the position assumed by Mr. Dollfus in this interesting letter. It must of course be left to the specialists engaged in the discussion to decide as to the specific independence of each form studied. All that we maintained was that difference of locality or horizon was not in itself sufficient ground for separating species. Some palæontologists do not seem to have very clear ideas on this matter.—Ed. Nat. Sci.]

Polychæta in the Cambridge Natural History.

May I point out some mistakes on the part of the writer of the Review, in the March number of Natural Science, of the section on Polychæta contributed by Dr. W. B. Benham to the second volume of the Cambridge Natural History.

The Reviewer draws up a somewhat alarming list of "Certain errors (*inter alia*) in general anatomy." The inclusion of *Haplobranchus* amongst the hermaphrodite Amphicorinidæ is certainly erroneous, as pointed out; but let us examine the other alleged "errors" *seriatim*. "The septa of the body are not so complete as to isolate the compartments . . the parapodia are essentially hollow organs, facts not explicitly stated"—if Dr. Benham's statements are not sufficiently clear on these points, they are not erroneous, but incomplete. "Prostomial tentacles are probably not restricted to the sub-order Nereidiformia"—a fact the reviewer might have

learnt even from his cursory reading of the book, since Dr. Benham clearly states (p. 260, figs. 133 and 134) that "in all the Nereidiformia, as well as in Sabelliformia and Chlorhæmidæ, the prostomium bears . . . tentacles," and again (p. 334) "The prostomium carries . . . several green tentacles," etc. If, as the reviewer states, Meyer (not "Mayer") was of opinion that "the tentacles of Spio may be prostomial," it can be answered that Benham has re-investigated the question, and is of opinion that they are peristomial. This may or may not be an advance in our knowledge; it cannot be called an "error." "The modified chætæ of *Capitella* are confined to the male"—as explicitly stated on p. 331. "Modified anterior chætæ occur in other Polychæta"—they are described and figured in several places (p. 315, 330, etc.). "All polycirrids are devoid of a vascular system"—it therefore cannot be an "error" to say (p. 253) that in "*Polycirrus hæmatodes* . . . the vascular system is absent." "In *Capitella* some, not all, of the cœlomic corpuscles are red"—it is nowhere explicitly stated that all the cœlomic corpuscles are red (p. 253), though no doubt it might have been clearer had the author stated that the presence of red corpuscles does not exclude the ordinary leucocytes mentioned as of universal occurrence in the previous paragraph. "The siphon is found in some Eunicidæ"—if this is not mentioned it is an omission, not an "error." If the author does not describe the longitudinal nephridial duct of Lanice—it is again not an "error," but an omission, perhaps intentional. "*Capitella* has one pair of gonoducts"—a peculiar fact among polychætes given on p. 331. "Other genera . . . more than one pair"—as mentioned on p. 305. The Reviewer complains that the development of the nephridia of *Polygordius* has not been described; he is apparently ignorant of the fact that the account we have (from Hatschek) is of very doubtful accuracy, and has not been confirmed. Moreover, as mentioned by Dr. Benham in the book, a detailed account of *Polygordius* and its development is to be found in another recent popular and accessible work, and it may be added in almost every text-book since Balfour's. I must confess that I feel somewhat relieved, when not always confronted with the same zoological "chestnuts."

Having levelled his false accusations at the author's head, the Reviewer has not a word of praise left for the many excellent qualities of the book. Not only does he appear quite to misunderstand the class of readers for which the work is intended, but also to be quite incapable of appreciating the originality and usefulness of the contributions. He is apparently not aware that this is the *first modern attempt* to deal in a broad yet thorough manner with the group Polychæta, and that it is undoubtedly the best general account of them given in any single work in any language. As a student of the anatomy of the polychætes, rather than dwell on a few incomplete statements, I feel bound to express my gratitude for, and wonder at, the immense amount of accurate and useful information the author has managed to condense into the hundred pages allowed him by the editors. Hitherto the difficult group Polychæta has been notoriously neglected in text-books—nowhere else can we find such clear and excellent illustrated accounts of the many puzzling questions in the morphology of these worms—such as those relating to the head, parapodia, chætæ, and gills.

Oxford University Museum. EDWIN S. GOODRICH.

[THE Sabelliformia and Chlorhæmidæ were, the Reviewer finds, duly included with the nereidiformia in his Notes. The names must have been accidentally omitted in copying out for the press, and the omission, to the Reviewer's most sincere regret, passed unnoticed in the proof at a time of great stress of other work. The criticism was directed to the words, p. 261 *ad fin.*, as to the non-existence of prostomial tentacles in "the other suborders." In the general description of chætæ (pp. 266–8), it is said on p. 267, *ad fin.*, that "certain modifications" of them "presented by various worms deserve mention." The worms thus singled out are *Polydera* and *Chætopterus* with exceptionally strong chætæ in one segment, *Capitella*, and *Aphrodite* with its iridescent bristles. As to *Capitella* the words run, "In *Capitella* those of the notopodium of the eighth and ninth segments are specially modified; they are analogous to the copulatory chæta of Oligochæta." The passage p. 331 relates to the species *Capitella capitata*. The words as to the red corpuscles of the Capitelliformia are "the red corpuscles become coloured with hæmoglobin" (p. 253), and

"the cœlomic corpuscles are red" (p. 305)—words which are certainly taken to mean *all corpuscles*. As to the gonoducts of the same suborder (not of "other genera" only, as Mr. Goodrich has it), it is said, p. 305, "special genital funnels exist in more or fewer of the anterior segments of the hind body." The passage, p. 331, relates to *Capitella capitata* alone, a smentioned before. The Reviewer has always regarded incomplete statements of fact, however they may arise, as very dangerous, and in nine cases out of ten as erroneous, especially if they appear to be complete or are certain to be taken as complete; and experience proves that they are a most fruitful source of error to others. He is well aware that Hatschek's observations on the larval *Polygordius* have not been confirmed, *nor yet disproved*, a position in which stand many most important and much-used facts. He is sorry to read the last paragraph of the letter. The writer has assuredly forgotten in particular the opening remarks of ample praise in the review. They were applied to the contents of the whole volume, and therefore to Polychæta; and they have at least sufficiently gratified the publishers of the Natural History to be quoted in a recent advertisement of the work.]

Mr. Berthelot on Science and Morality.

There are one or two points brought forward in Mr. Berthelot's recent work "Science et Morale" that ought to be carefully considered, and are especially interesting and important as bearing on the attitude of certain eminent men in this country towards science and culture. The first point relates to the ultimate predominance of science in all human affairs. "Science," says Mr. Berthelot, "dominates all things, it alone is of any definite utility. No man, no institution shall henceforth have an enduring authority if they do not conform themselves to its precepts." Now, it may be remarked that, although in a mundane sense science actually does *dominate* everything, it is scarcely correct to hold, as Mr. Berthelot does, that morality has no other basis than that which science furnishes. The true basis of morality, humanly speaking, is humanity, *i.e.* it is the emotions, not the intellect—it is the native-born appetency of the heart, which, however, being a mere blind force and not a guiding law, will inevitably lead to ruin unless it be authoritatively dominated by the highest intelligence, *i.e.* by science. Hence, moreover, it is just this misconception involved in the attributing everything to science, or rather in not confining it strictly within its own functional limits, that is the true cause of the enmity exhibited towards the ecclesiastical spirit by Berthelot, Huxley, and other eminent men. The ecclesiastical spirit is, like everything else, as these castigators would admit if they could only see it, "dominated by science"; and where this influence fails, it degenerates into a form of selfishness, which certainly merits all the vituperation shed on it by clever platform rhetoricians. Mr. Berthelot, like Huxley, is a good hater of "false pretence and unscientific method," but it is not very creditable to these men that they should seek to fasten these characteristics on the ecclesiastical spirit properly so-called, or on its sound-headed impersonators. In fact, it is exactly this sort of thing that has inflicted on science in our country the most deterrent and retrograde blow that it has perhaps ever received at any epoch. Why cannot our fashionable orators and writers of lay sermons understand this much, viz., that the kind and quality of intelligence and ideas that lead to the correct and proper study of science lead also to correct and proper ideas anent religion and morals.

If the foregoing views be correct, it will be tolerably easy for anyone to understand how it is that so much of Mr. Berthelot's powers and talents have been diverted from the channel of pure chemistry and veritable science to that of mechanics. In point of fact, it would seem, according to his later works at all events, that his real *forte* is that of a mechanical engineer, *i.e.*, the skilful, accurate, and definite application of science to industry. If this be so, then we can further understand most of "the rest of it." For instance, his hostility to the divine origin of moral laws, his failure to see that no amount of what he calls "le mecanisme de la preparation" for admission into the higher schools can seriously and permanently affect the health of an originally sound mind or sound body. It may be averred with considerable assurance that the strain inflicted on youthful candidates, save

and unless they are swayed by monetary and selfish considerations, or are compelled unnecessarily to undergo extra physical exertion at the same time, does not, as Mr. Berthelot maintains, produce "an abdication of their individuality, a hindrance of their normal development, or a loss of their curiosity and love of original reflection."

P. Q. KEEGAN.

London, *March* 12, 1897.

ANGLO-SAXON *versus* GRAECO-LATIN.

I HAVE been much pleased with the editorial "Notes and Comments" in which, from time to time, you have rebuked the pedantry of certain writers on science, although I have sometimes thought you fail to make allowance for the hard fate which drives them to endless search for new technical words, even when these seem needless and shocking to the mere literary man.

I know I shall have your sympathy if I tell of my own humiliation. This is the cause of my grief. I had written that the heart of the grasshopper is under the middle line of its back: and a compiler of books has, by his emendations, given me to understand that scientific precision demands that I should have drawn on the resources of dog-Latin and bastard Greek, and said: "The pseud-haemal vessel is pseudo-ventral to the pseudo-dorsi-meson." I have taken the correction for my own good, with chastened gratitude; and I note with pleasure that while you express your well-founded doubt of the existence in nature of anything to give the name to, you nevertheless hold fast to the good old Saxon name "Telegony" (NATURAL SCIENCE, Feb., 1897, p. 80).

Johns Hopkins University, Baltimore, Md., U.S.A. W. K. BROOKS.

W. G. BINNEY AS A MALACOLOGIST.

WITH reference to the Note in our January number, on Messrs. Pilsbry and Vanatta's Revision of North American Slugs, Mr. T. D. A. Cockerell protests against our statement: "Here for the first time the introduction of new species is accompanied by descriptions and figures of the internal parts," &c. He complains that we are ignoring the works of W. G. Binney. Binney's work was good so far as it went—very good for a pioneer; but our sentence continued—"in a manner similar to that employed by such English and Continental malacologists as Simroth, Lessona, *et alii*." Binney's descriptions and figures are, we maintain, *not* similar to those of the writers we mentioned, or to those of Pilsbry and Vanatta. They are in some cases far too short, and place too much reliance on external characters and those of the lingual ribbon.

NOTICE.

TO CONTRIBUTORS.—*Communications for the June Number to be addressed to the* EDITOR *of* NATURAL SCIENCE, *at* 22 ST. ANDREW STREET, HOLBORN CIRCUS, LONDON, E.C.

The July Number (being the first of Volume XI.) will be published by MESSRS. J. M. DENT & CO., 67 ST. JAMES'S STREET, S.W., *to which address the Editorial Offices will be transferred.*

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